Paul A. Colbert
Associate General Counsel
Regulatory Affairs

December 2, 2019

Hon. Michelle L. Phillips
Acting Secretary
New York State Public Service Commission
Agency Building 3
Albany, NY 12223-1350

Re: Case 14-E-0318 - *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Central Hudson Gas & Electric Corporation for Electric Service*

Dear Secretary Phillips:

Central Hudson Gas & Electric Corporation (Central Hudson) hereby submits for filing in the above-referenced case its 2019 Annual Report for the Targeted Demand Management (TDM) Program, a Central Hudson Non-Wires Solution.

Please contact Mark Sclafani at (845)486-5979 or msclafani@cenhud.com with any questions regarding this matter.

Respectfully submitted,

/s/*Paul A. Colbert*

Paul A. Colbert
Associate General Counsel
Regulatory Affairs

284 South Avenue
Poughkeepsie, NY 12601

(845) 452-2000
Phone: (845) 486-5831 Cell: (614) 296-4779
Email: pcolbert@cenhud.com
www.CentralHudson.com

STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Central Hudson Gas & Electric Corporation for Electric Service	**Case 14-E-0318**

Central Hudson Gas & Electric Corporation's 2019 Annual Report for the Targeted Demand Management (TDM) Program, a Central Hudson Non-Wires Alternative

December 2, 2019

CENTRAL HUDSON GAS & ELECTRIC CORPORATION
284 South Avenue
Poughkeepsie, N.Y. 12601

Contents

1. Background

On July 15, 2016 the Commission issued an Order[1] concerning Central Hudson Gas & Electric Corporation's ("Central Hudson" or "the Company") Non- Wires Alternative ("NWA") project. The Order directed Central Hudson to "develop an operating procedure for the calculation of the financial incentive, including the milestones, as described in the body of the order and file such procedure within 30 days of the issuance of this Order[2]." The Company subsequently requested an extension of the filing deadline to September 15, 2016, which was granted. In the Operation Procedure for NWA Incentives[3] ("Operation Procedure"), the Company detailed key NWA results which would be provided to Staff each year on December 1st. Following consultation with DPS Staff, the Company filed updated versions 2.0and 3.0 to the Operation Procedure on September 6, 2017 and December 1, 2018, respectively.

2. Non-Wires Alternative Overview

Central Hudson's portfolio of solutions designed to meet the needs identified within this NWA, are collectively known as the Targeted Demand Management ("TDM") program. The TDM program includes several strategies and technology types. The program has been deployed within three specific load zones in Central Hudson's service territory: Fishkill/Shenandoah, Merritt Park, and the Northwest Corridor. Throughout these areas, a total load relief of 16.0 MW is targeted in order to successfully defer infrastructure investments in each location.

Demand Response "Peak Perks" Program

The demand response portion of the program, referred to as "Peak Perks" is being implemented by Itron, a third-party program administrator. Residential and small commercial customers may participate in Peak Perks using direct load control devices. Such devices are installed by Itron on qualifying equipment at the customer site. Eligible participants receive a free installed WiFi enabled thermostat to control their central air conditioning system. Digital control units

[1] Case 14-E-0318, Rates, Charges, Rules and Regulations of Central Hudson Gas & Electric Corporation for Electric Service, Order implementing with Modification The Proposal for Cost Recovery and Incentive Mechanism for Non- Wire Alternative Project ("July 15th Order") (issued July 15th 2016).

[2] Order implementing with Modification The Proposal for Cost Recovery and Incentive Mechanism for Non- Wire Alternative Project ("July 15th Order") (issued July 15th 2016).

[3] Case 14-E-0318, et al., supra, filed on September 15, 2016.

("DCU's") are also used to curtail central air conditioners and pool pumps, and activate backup generation systems. Participants receive upfront and recurring incentives for each year of participation.[4]

Large commercial and industrial ("C&I") customers may participate in the program by committing to curtail their electricity usage when called upon by Central Hudson. Participants earn a reservation payment of $6.82/kW-month.

Targeted Energy Efficiency

In September 2018, the Company launched a targeted C&I energy efficiency initiative within the TDM zones. The initiative has continued through 2019 and is designed to impact locational loads by concentrating efficient retrofit projects within NWA areas. High adoption rates are achieved using enhanced incentives and marketing. This initiative has supplemented load reductions achieved through the Peak Perks program.

3. Operations & Marketing

Demand Response "Peak Perks" Program

To recruit residential and small commercial participants into the Peak Perks program, a comprehensive marketing campaign has been utilized which includes door-to-door sales, outbound calling, direct mail marketing, and an educational website located at www.Cenhubpeakperks.com. A team of technicians has been deployed to install direct load control devices on qualifying equipment. Over 30% participation has been achieved within certain regions.[5]

Customer service operations are supported by Itron's call center, with Central Hudson's contact center providing supplemental support. Itron's solution operation center, and IntelliSOURCE demand response management system are utilized to initiate and monitor curtailment events.

Large C&I participants are recruited through CPower, Itron's subcontractor. CPower is responsible for aggregating and managing the C&I population, and maximizing performance during events.

The Company is currently evaluating the inclusion of energy storage technology into the Peak Perks program under existing program delivery and contract structures for 2020.

[4] Incentives are paid per device installed.
[5] Over 30% of eligible participants in the Fishkill/Shenandoah region with central air conditioning are currently participating in the Peak Perks program.

Targeted Energy Efficiency

The targeted energy efficiency initiative is being implemented through Lime Energy, in coordination with the Company's existing small business direct install energy efficiency program. Lime Energy conducts most of the program operations out of their office in Beacon, NY which is within Central Hudson's service territory. Lime performs a free onsite energy audit and provides the customer with a proposal showing pre-existing and post-installation energy consumption details, payment options, incentives, payback information, and terms and conditions of the program. Customers within the NWA areas receive up to 100% of the project cost covered through incentives. The program is fully "turnkey," with installations completed using a network of qualified installers. To date, these projects have been focused on lighting. However, the Company is exploring additional measures, such as refrigeration and HVAC, for inclusion in 2020.

4. Program Results

This year, the Peak Perks program had a total of four curtailment events for the residential and small commercial populations and one test event for the large commercial and industrial (C&I) population.[6] Performance during qualifying events has been used to calculate the available load reduction within the program. Additionally, 519 targeted lighting projects have been completed[7]. The contribution of each lighting project is determined with respect to its estimated coincidence with locational needs.

As of 9/30/2019, Central Hudson has achieved 11,997 kW of available capacity within the TDM Peak Perks Program, as shown in the table below. Additional capacity of 1,554 kW and 508 kW has been achieved through targeted efficiency and avoided line losses, providing a total program impact of 14,059 kW. Detailed measurement and verification results for the Peak Perks portion of the TDM program are provided in "Appendix A: Central Hudson Gas & Electric Peak Perks Program 2019 Load Control Impact Evaluation Report."[8]

Table 1: Overall Program Impacts

[6] Four Large C& I customers were called for a re-test
[7] Lighting Projects from September 1, 2018 through September 30,2019
[8] Appendix A presents program impacts as determined by measurements obtained at the customer site, and do not include avoided upstream distribution losses

Load Zone	Peak Perks: Residential & Small Commercial (kW)	Peak Perks: Large C&I (kW)	Targeted Efficiency (kW)	Avoided Line Losses (kW)	Total kW Available
Fishkill/Shenandoah	2,558	80	475	152	3,265
Merritt Park	293	664	8	45	1,010
Northwest Corridor	1,308	7094	1,071	311	9,784
Total	**4,159**	**7,838**	**1,554**	**508**	**14,059**

Table 2: Targeted Efficiency Impacts

Load Zone	Number of Projects	Peak kW	Locational Coincidence	Effective kW	Average kW per Project
Fishkill/Shenandoah	223	814	58.40%	475	3.65
Merritt Park	5	11	69.10%	8	2.20
Northwest Corridor	291	1828	58.60%	1071	6.28
Total	**519**	**2653**		**1554**	**5.11**

5. Avoided Line Losses

Per the Operation Procedure version 3.0, the avoided line losses are incorporated into the calculation of load reductions. The line loss percentages that have been utilized within these formulas are detailed within the following table. Because the retail delivery point varies based on service characteristics, different line loss percentages have been used based on service type.

Table 3: Line Loss Factors

Service Type	Line Losses Included	Loss %[9]
Secondary Metered	Primary & Secondary Line Losses	4.70%
Primary Metered	Primary Line Losses	2.54%
Transmission Service	None	0%

All residential and small commercial participants are considered to be secondary metered. Individual line loss contributions are calculated for larger C&I participants based on their service type.

Transmission line losses are not considered for the purposes of this analysis. The deferred projects within Fishkill/Shenandoah and Merritt Park are primary distribution infrastructure, and so avoided line losses on the upstream transmission system do not contribute to that deferral. In the case of the Northwest Area, a transmission project is being deferred. This project, however, represents only a small portion of the bulk transmission system for which transmission line loss percentage has been calculated. The avoided line loss contribution within this small portion is approximated to be zero.

6. Benefit Cost Analysis ("BCA")

Central Hudson has performed a BCA analysis of the TDM Program. The overall results of the program are included below:

Table 4: BCA Results

BCA Test[10]	Results
Societal Cost Test	1.49
Utility Cost Test	1.40
Ratepayer Impact Measure	1.40

[9] Loss percentages are taken from Central Hudson Gas & Electric Benefit-Cost Analysis (BCA) Handbook, Version 2.0., filed 8/31/18, Case 16-M-0412

[10] Performed in accordance with Central Hudson Gas & Electric Benefit-Cost Analysis (BCA) Handbook, Version 2.0. filed 8/31/18, Case 16-M-0412

Appendix A: Central Hudson Gas & Electric Peak Perks Program 2019 Load Control Impact Evaluation Report

Central Hudson Gas & Electric Peak Perks Program 2019 Load Control Impact Evaluation Report

Strategic Analytics

November 5, 2019

www.Itron.com

RELEASE 1.0: NOVEMBER, 2019

Contents

List of Figures

List of Tables

Change Notice

Table 1: Change Notice

Version	Date	Description of Changes
1.00	11/05/2019	First Release

1 Executive Summary

This report details the 2019 operation and load reduction results of the Central Hudson Gas & Electric Corporation (CHGE) Targeted Demand Management program, also referred to as the CenHub Peak Perks program.

The Peak Perks program targets central air conditioning systems in both the residential and commercial segments and pool pumps in the residential segment for demand response conservation events. More recently, the program also began targeting whole home generators. The program is open to customers in the Targeted Demand Management (TDM) load zones, which include: Northwest Corridor, Merritt Park, and Fishkill/Shenandoah.

The program uses IntelliTEMP DirectLink smart thermostats and IntelliPEAK load control devices to automate the curtailing of central air conditioning (A/C) and pool pump loads, and curtailing the whole home for the generator program. It also uses the Itron IntelliSOURCE Demand Response Management System (DRMS) platform to enroll customers in the program, manage day-to-day program activities, optimize event readiness, curtail program devices for load reduction events, measure program performance, and analyze program results.

This year, Central Hudson called a total of four curtailment events for the residential and small commercial participant populations and one test event for each of the large commercial & industrial (C&I) participant population, with four C&I customers participating in a retest event. For residential and small commercial, only the event hours where the temperature was at or above 93°F are considered as the Analysis Hours. One of the four curtailment events for the residential and small commercial populations had hours that exceeded this threshold and were considered Analysis Hours.

Table 2, below, presents the total MW reduction for the 2019 control season by segment. The demand response reduction for the residential and small commercial participant populations is 4.159 MW, based on the total installed end points of 4,053 throughout the Central Hudson Peaks Perks program service area as of September 30th, 2019. The demand response reduction for the C&I participant population is 7.838 MW based on the curtailment performance of eleven customers. The demand response reduction for the entire Peak Perks program is 11.997 MW.

Table 2: Summary of Reduction

Population	Device	Active end points as of 10/01/19	kW Factor (Hourly Avg)	Total MW Savings
Residential	Thermostat - A/C	989	1.229	1.215
Residential	DCU - A/C	2,757	0.932	2.570
Residential	DCU - Pool Pump	63	0.506	0.032
Residential	DCU - Generator	42	2.371	0.100
Small Commercial	Thermostat - A/C	97	1.476	0.143
Small Commercial	DCU - A/C	105	0.947	0.099
Large C&I	Curtailment	11		7.838
Total		4,064		11.997

Note: Small Commercial DCU devices were not evaluated. The kW factor for this segment is estimated based on the relationship of residential thermostat to DCU savings per ton.

2 Participant Summary

The status of the Peak Perks participants and other program details, such as equipment and device type are recorded in the Itron IntelliSOURCE system. As of the end of September 2019, there were 4,053 active end points for the residential and small commercial populations contained in IntelliSOURCE. *Table 3* shows the number of net installations for the summer months.

Table 3: Net Installations

Month	Residential Thermostats	Residential DCUs	Residential Pool Pumps	Residential Generators	Small Commercial Thermostats	Small Commercial DCUs
Through May 31, 2019	1,019	2,768	67	35	99	109
June	-6	35	0	4	0	-1
July	-7	-26	-1	-1	-2	-3
August	-11	-17	-3	2	0	0
September	-6	-3	0	2	0	0
As of September 30, 2019	989	2,757	63	42	97	105

In addition to the residential and small commercial participant populations, there were eleven C&I (large commercial) participants as of September 30, 2019. All C&I participants agreed to take curtailment actions during event hours as specified in a Demand Response Curtailment Plan. Seven C&I participants were in the Northwest Corridor, three in Merritt Park, and one in Fishkill.

This section details the Demand Response (DR) program participant population used in determining the performance of the program. The status of each participant and their program information is recorded in IntelliSOURCE. As part of each control device installation on an air conditioner (A/C) unit, the size of the air conditioner is recorded as tonnage. Similarly, for each control device installed on a pool pump, the horsepower is recorded and for the whole home generator, the kW output is recorded.

Table 4, below, presents a summary of the active participants as of September 30, 2019 that is contained in IntelliSOURCE.

Table 4: Total Active Participant Counts per IntelliSOURCE

Population	Device	Available Size	Missing Size	Total
Residential	Thermostat - A/C	955	34	989
Residential	DCU - A/C	2,695	62	2,757
Residential	DCU - Pool Pump	63		63
Residential	DCU - Generator	42		42
Small Commercial	Thermostat - A/C	85	12	97
Small Commercial	DCU - A/C	102	3	105

2.1 Residential A/C Thermostat Participant Population (Two-Way Devices)

Table 5 shows the distribution of A/C tonnage for the residential thermostat participants as of September 30, 2019 by region.

Table 5: Residential A/C Thermostat Participant Tonnage Distribution

Tons Bin	Fishkill Count	Fishkill Pct	Merritt Park Count	Merritt Park Pct	NW Corridor Count	NW Corridor Pct	Total Count	Total Pct
<1.0	0	0.00	0	0.00	0	0.00	0	0.00
1.0	0	0.00	0	0.00	0	0.00	0	0.00
1.5	20	2.58	5	7.46	5	3.42	30	3.03
2.0	138	17.78	12	17.91	26	17.81	176	17.80
2.5	129	16.62	17	25.37	43	29.45	189	19.11
3.0	238	30.67	9	13.43	46	31.51	293	29.63
3.5	101	13.02	9	13.43	3	2.05	113	11.43
4.0	98	12.63	10	14.93	10	6.85	118	11.93
4.5	0	0.00	0	0.00	0	0.00	0	0.00
5.0	28	3.61	4	5.97	4	2.74	36	3.64
>5.0	0	0.00	0	0.00	0	0.00	0	0.00
Missing	24	3.09	1	1.49	9	6.16	34	3.44
Total	776	100.00	67	100.00	146	100.00	989	100.00

Note: Tonnage bins are presented as top value of a range such that the tonnage is greater than the previous bin and less than or equal to the current bin value. (previous bin < tonnage <= current bin)

Approximately 90% of all residential A/Cs with thermostats installed are between two tons and four tons, while the average is 2.93 tons. *Figure 1* shows the distribution of tonnage for active residential A/C thermostats as of September 30, 2019.

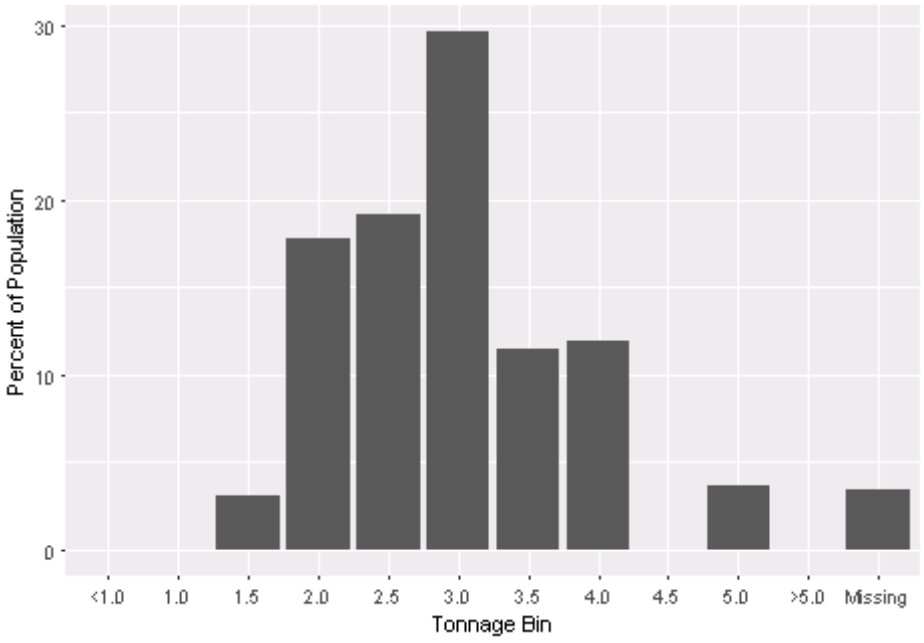

Figure 1: Residential Thermostat A/C Tonnage Distribution

Additional statistics for the tonnage are shown in *Table 6* below.

Table 6: Residential A/C Thermostat Participant Tonnage Statistics

Statistic	Value
Mean	2.93
Median	3.00
Upper 95%	4.00
Lower 5%	2.00
Standard Deviation	0.78

2.2 Small Commercial A/C Thermostat Participant Population (Two-Way Devices)

Table 7 shows the distribution of tonnage for the small commercial A/C thermostat participants as of September 30, 2019 by region.

Table 7: Small Commercial A/C Thermostat Participant Tonnage Distribution

Tons Bin	Fishkill Count	Fishkill Pct	Merritt Park Count	Merritt Park Pct	NW Corridor Count	NW Corridor Pct	Total Count	Total Pct
<1.0	0	0.00	0	0	0	0	0	0.00
1.0	0	0.00	0	0	0	0	0	0.00
1.5	0	0.00	0	0	0	0	0	0.00
2.0	2	2.99	0	0	1	4	3	3.09
2.5	6	8.96	0	0	1	4	7	7.22
3.0	6	8.96	0	0	1	4	7	7.22
3.5	1	1.49	0	0	1	4	2	2.06
4.0	20	29.85	0	0	2	8	22	22.68
4.5	0	0.00	0	0	0	0	0	0.00
5.0	27	40.30	3	60	7	28	37	38.14
>5.0	3	4.48	0	0	4	16	7	7.22
Missing	2	2.99	2	40	8	32	12	12.37
Total	67	100.00	5	100	25	100	97	100.00

Note: Tonnage bins are presented as top value of a range such that the tonnage is greater than the previous bin and less than or equal to the current bin value. (previous bin < tonnage <= current bin)

Approximately 70% of all small commercial A/C thermostat participants have an A/C that is between three tons and five tons, while the average is 4.41 tons. *Figure 2* shows the distribution of tonnage for active small commercial A/C thermostat participants as of September 30, 2019.

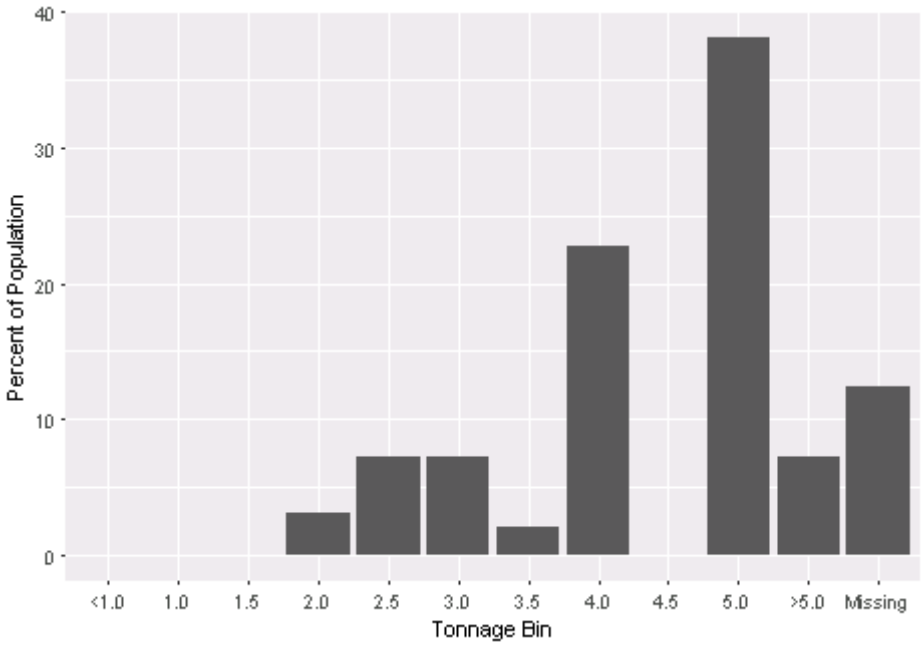

Figure 2: Small Commercial A/C Thermostat Participant Tonnage Distribution

Additional statistics for the A/C tonnage are shown in *Table 8*.

Table 8: Small Commercial A/C Thermostat Participant Tonnage Statistics

Statistic	Value
Mean	4.41
Median	5.00
Upper 95%	6.00
Lower 5%	2.50
Standard Deviation	1.30

2.3 Residential A/C DCU Participant Population (One-Way Devices)

Table 9 shows the distribution of tonnage for the residential A/C DCU participants as of September 30, 2019 by region.

Table 9: Residential A/C DCU Participant Tonnage Distribution

Tons Bin	Fishkill Count	Fishkill Pct	Merritt Park Count	Merritt Park Pct	NW Corridor Count	NW Corridor Pct	Total Count	Total Pct
<1.0	0	0.00	0	0.00	0	0.00	0	0.00
1.0	1	0.07	0	0.00	1	0.09	2	0.07
1.5	31	2.10	11	5.56	46	4.24	88	3.19
2.0	156	10.58	25	12.63	203	18.71	384	13.93
2.5	256	17.37	53	26.77	285	26.27	594	21.55
3.0	440	29.85	67	33.84	291	26.82	798	28.94
3.5	212	14.38	11	5.56	93	8.57	316	11.46
4.0	228	15.47	17	8.59	88	8.11	333	12.08
4.5	0	0.00	0	0.00	1	0.09	1	0.04
5.0	130	8.82	9	4.55	39	3.59	178	6.46
>5.0	0	0.00	0	0.00	1	0.09	1	0.04
Missing	20	1.36	5	2.53	37	3.41	62	2.25
Total	1,474	100.00	198	100.00	1,085	100.00	2,757	100.00

Note: Tonnage bins are presented as top value of a range such that the tonnage is greater than the previous bin and less than or equal to the current bin value. (previous bin < tonnage <= current bin)

Approximately 88% of all residential A/C DCU participants have an A/C between two tons and four tons, while the average is 3.02 tons. *Figure 3* shows the distribution of tonnage for active residential A/C DCU participants as of September 30, 2019.

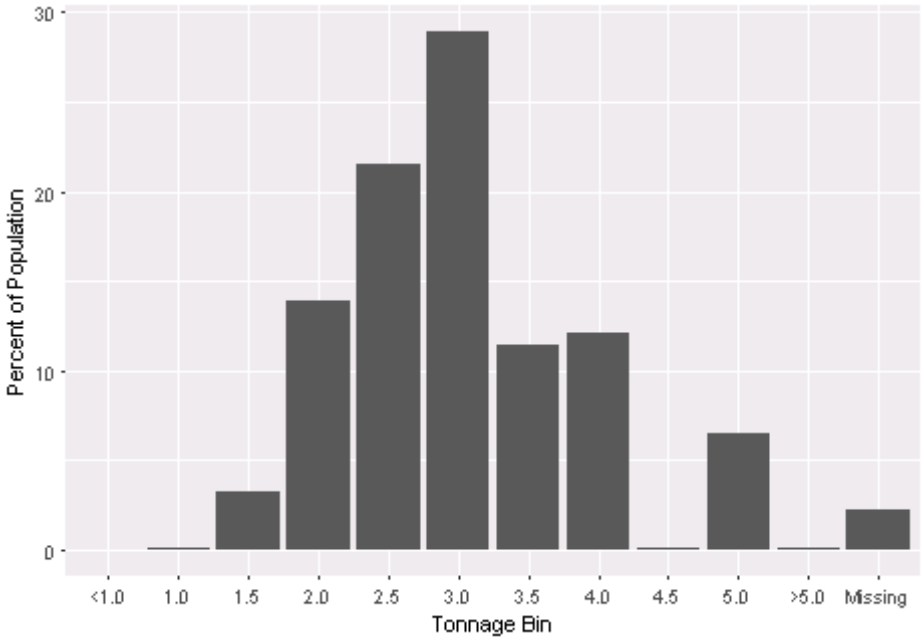

Figure 3: Residential A/C DCU Participant Tonnage Distribution

Additional statistics for the A/C tonnage are shown in *Table 10*.

Table 10: Residential A/C DCU Participant Tonnage Statistics

Statistic	Value
Mean	3.02
Median	3.00
Upper 95%	5.00
Lower 5%	2.00
Standard Deviation	0.87

2.4 Small Commercial A/C DCU Participant Population (One-Way Devices)

Table 11 shows the distribution of tonnage for the small commercial A/C DCU participants as of September 30, 2019 by region.

Table 11: Small Commercial A/C DCU Participant Tonnage Distribution

Tons Bin	Fishkill Count	Fishkill Pct	NW Corridor Count	NW Corridor Pct	Total Count	Total Pct
<1.0	0	0.00	0	0.00	0	0.00
1.0	0	0.00	0	0.00	0	0.00
1.5	0	0.00	0	0.00	0	0.00
2.0	4	5.13	2	7.41	6	5.71
2.5	2	2.56	3	11.11	5	4.76
3.0	12	15.38	10	37.04	22	20.95
3.5	19	24.36	0	0.00	19	18.10
4.0	12	15.38	6	22.22	18	17.14
4.5	0	0.00	0	0.00	0	0.00
5.0	25	32.05	5	18.52	30	28.57
>5.0	1	1.28	1	3.70	2	1.90
Missing	3	3.85	0	0.00	3	2.86
Total	78	100.00	27	100.00	105	100.00

Note: Tonnage bins are presented as top value of a range such that the tonnage is greater than the previous bin and less than or equal to the current bin value. (previous bin < tonnage <= current bin)

Approximately 85% of all small commercial A/C DCU participants have an A/C between three tons and five tons, while the average is 3.85 tons. *Figure 4* shows the distribution of tonnage for active small commercial A/C DCU participants as of September 30, 2019.

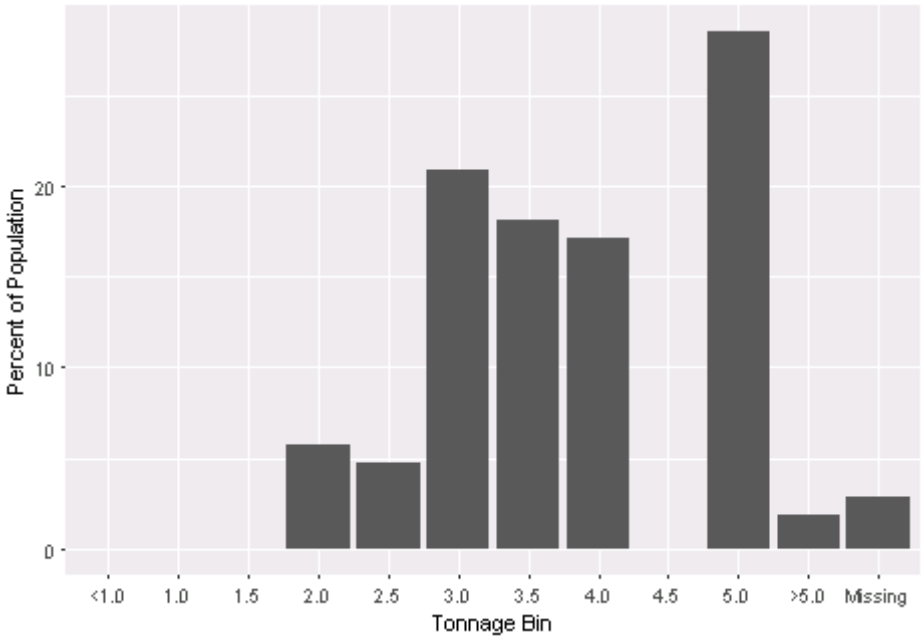

Figure 4: Small Commercial A/C DCU Participant Tonnage Distribution

Additional statistics for the A/C tonnage are shown in *Table 12*.

Table 12: Small Commercial A/C DCU Participant Tonnage Statistics

Statistic	Value
Mean	3.85
Median	3.50
Upper 95%	5.00
Lower 5%	2.03
Standard Deviation	1.02

2.5 Residential DCU Pool Pump Population

Table 13 shows the distribution of horsepower for the residential pool pump DCU participants as of September 30, 2019 by region.

Table 13: Residential Pool Pump DCU Participant Horsepower Distribution

Horsepower Bin	Fishkill Count	Fishkill Pct	NW Corridor Count	NW Corridor Pct	Total Count	Total Pct
<1.0	0	0.00	0	0.00	0	0.00
1.0	11	33.33	19	63.33	30	47.62
1.5	22	66.67	10	33.33	32	50.79
2.0	0	0.00	1	3.33	1	1.59
Missing	0	0.00	0	0.00	0	0.00
Total	33	100.00	30	100.00	63	100.00

Note: Horsepower bins are presented as top value of a range such that the horsepower is greater than the previous bin and less than or equal to the current bin value. (previous bin < horsepower <= current bin)

Figure 5 shows the distribution of horsepower for active residential pool pump DCU participants as of September 30, 2019.

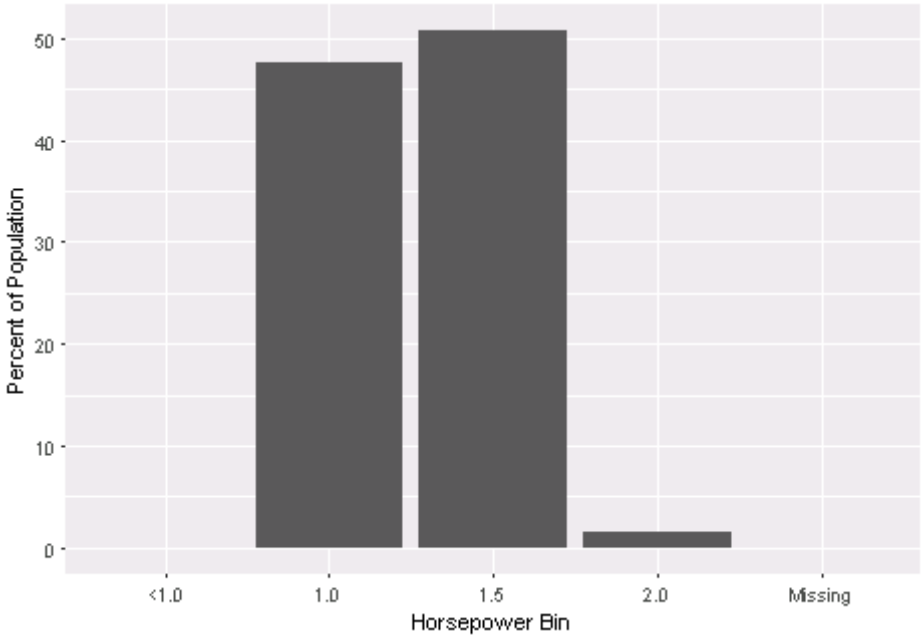

Figure 5: Residential Pool Pump Horsepower Distribution

The overall pool pump horsepower distribution is shown in *Table 14*.

Table 14: Residential Pool Pump Horsepower Statistics

Statistic	Value
Mean	1.27
Median	1.50
Upper 95%	1.50
Lower 5%	1.00
Standard Deviation	0.27

2.6 Whole Home Generator Participant Population

Table 15 shows the distribution of generator size as kW output for the residential whole home generator participants as of September 30, 2019 by region.

Table 15: Residential Generator Participant kW Output Distribution

kW Bin	Fishkill Count	Fishkill Pct	Merritt Park Count	Merritt Park Pct	NW Corridor Count	NW Corridor Pct	Total Count	Total Pct
14	1	5.88	0	0.0	2	11.76	3	7.14
16	3	17.65	1	12.5	8	47.06	12	28.57
17	5	29.41	0	0.0	1	5.88	6	14.29
20	6	35.29	3	37.5	2	11.76	11	26.19
22	2	11.76	3	37.5	4	23.53	9	21.43
27	0	0.00	1	12.5	0	0.00	1	2.38
Total	17	100.00	8	100.0	17	100.00	42	100.00

Note: kW bins are presented as top value of a range such that the kW is greater than the previous bin and less than or equal to the current bin value. (previous bin < kW <= current bin)

Figure 6 shows the distribution of kW output for active residential whole home generator participants as of September 30, 2019.

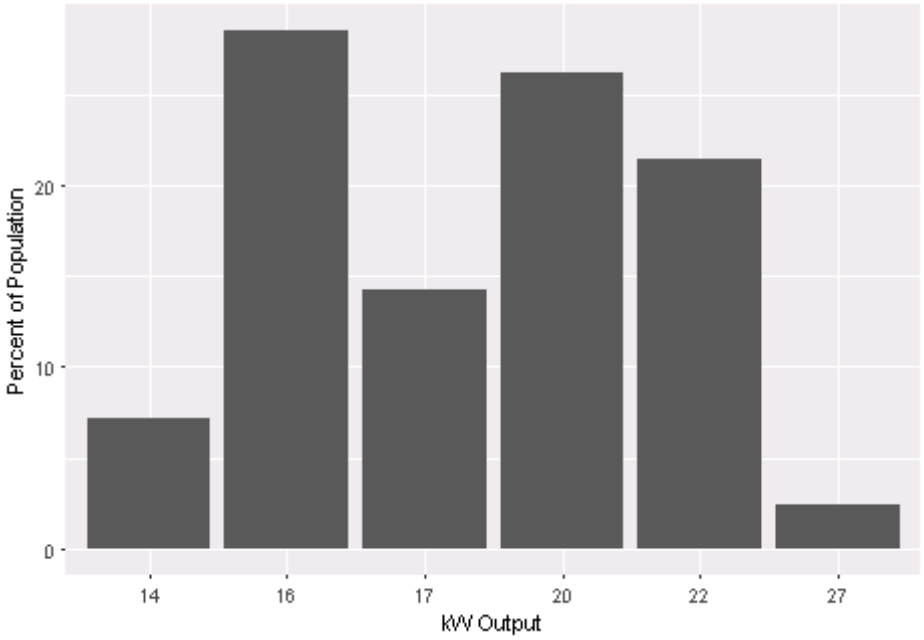

Figure 6: Residential Generator kW Output Distribution

The overall whole home generator kW output distribution is shown in *Table 16*.

Table 16: Residential Generator kW Output Statistics

Statistic	Value
Mean	18.60
Median	18.50
Upper 95%	22.00
Lower 5%	14.10
Standard Deviation	2.95

2.7 C&I (Large Commercial) Participant Population

As of September 30, 2019, there are seven C&I participants in the Northwest Corridor, three in Merritt Park and one in Fishkill.

3 Curtailment Algorithms

The Itron IntelliSOURCE energy management platform is configured for the different rate contracts required to support this program. A rate contract is used to specify a group of devices that are curtailed in a similar manner. *Table 17* presents the rate contracts for this program that have active participants as of September 30, 2019.

Table 17: Peak Perks Program Rate Contracts

Rate Contract	Description	Device Type
Residential-AC-Switch-50	Residential - A/C DCUs - 50% Curtailment	One-Way
Residential-AC-Switch-75	Residential - A/C DCUs - 75% Curtailment	One-Way
Residential-AC-Switch-100	Residential - A/C DCUs - 100% Curtailment	One-Way
Residential-Thermostat-50	Residential - A/C Thermostats - 50% Curtailment	Two-Way
Residential-Thermostat-75	Residential - A/C Thermostats - 75% Curtailment	Two-Way
Residential-Thermostat-100	Residential - A/C Thermostats - 100% Curtailment	Two-Way
Residential-PP	Residential - Pool Pumps - 100% Curtailment	Two-Way
Residential-WHG	Residential - Whole Home Generators - 100% Curtailment	Two-Way
Commercial-AC-Switch-30	Small Commercial - A/C DCUs - 30% Curtailment	One-Way
Commercial-AC-Switch-50	Small Commercial - A/C DCUs - 50% Curtailment	One-Way
Commercial-Thermostat-30	Small Commercial - A/C Thermostats - 30% Curtailment	Two-Way
Commercial-Thermostat-50	Small Commercial - A/C Thermostats - 50% Curtailment	Two-Way
Large-Commercial C&I	Large Commercial C&I Customers	N/A

The IntelliSOURCE system is configured with curtailment templates before the start of the season. These templates are used by Central Hudson to schedule events based on load need. The difference between each of the curtailment templates is the type of curtailment initiated.

At the beginning of the 2016 program year, the curtailment strategies were 50% Adaptive Distributed Intelligence (ADI) for residential and 30% or 50% ADI for small commercial. After the 2016 control season, 75% ADI and 100% shed were added to the residential curtailment strategies. Examples of the curtailment strategies are provided below in *Figure 7* through *10*. The curtailment strategy for pool pumps and whole home generators is 100% shed.

Figure 7 shows the Adaptive 30% curtailment strategy as it pertains to the participant population. In this graph, it takes approximately 9 minutes for the population to reach a steady state where one-third of the devices are in curtailment. This plateau remains until the end of the event. All devices are restored by 30 minutes after the event end time.

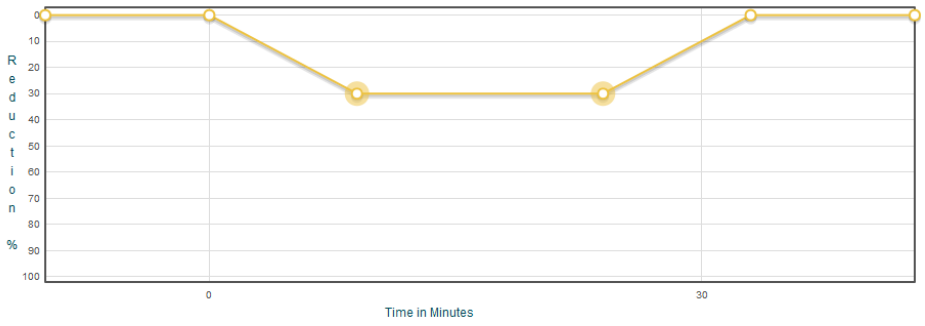

Figure 7: 30% ADI Curtailment Strategy

Figure 8 shows the ADI 50% curtailment strategy as it pertains to the participant population. In this graph, it takes approximately 15 minutes for the population to reach a steady state where 50% of the devices are

in curtailment. This plateau remains until the end of the event. All devices are restored 30 minutes after the event end time.

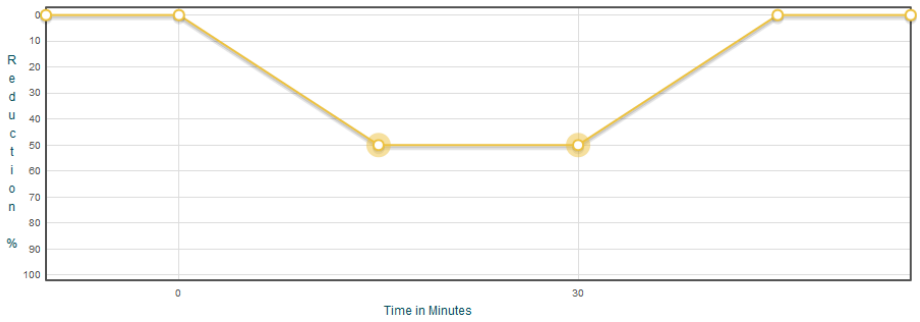

Figure 8: 50% ADI Curtailment Strategy

Figure 9 shows the ADI 75% curtailment strategy as it pertains to the participant population. In this graph, it takes approximately 22.5 minutes for the population to reach a steady state where 75% of the devices are in curtailment. This plateau remains until the end of the event. All devices are restored 30 minutes after the event end time.

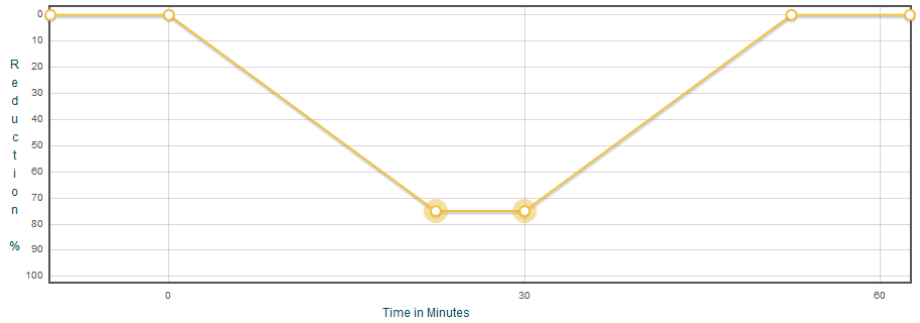

Figure 9: 75% ADI Curtailment Strategy

Figure 10 shows the Immediate 100% Shed curtailment strategy as it pertains to the participant population. In this graph, all devices begin curtailment immediately and remain in curtailment until the end of the event. A +/- 1.5-minute randomized ramp out is employed at the end of curtailment.

Figure 10: Immediate 100% Shed Curtailment Strategy

4 Evaluation Algorithms

4.1 Residential and Small Commercial

This section describes the method used to evaluate the impact of the 2019 load curtailment events for the residential and small commercial participant populations. The event hours where the temperature was at or above 93°F are referred to throughout the remainder of the of this section as the Analysis Hours.[1] Itron may also call up to two M&V events per Control Season provided that the duration of the M&V events is equal to or less than two hours each for each device type. The Itron-called M&V events are not subject to any threshold criteria.

The kW factor is calculated separately for each sub-population: residential A/C thermostat, small commercial A/C thermostat, residential A/C DCU, small commercial A/C DCU, residential pool pump DCU, and generators.

The kW factor for each population is based on an average of all Analysis Hours for the 2019 season. The first 15-minute interval for each event is excluded as this time interval is when the population is ramping into curtailment.

Where applicable, the final load impact estimate calculations were initially based on a baseline methodology defined in NYISO Emergency Demand Response Program Manual (entitled The Average Day CBL[2] for Weekdays.[3]). In 2019, DSA (the third-party consultant) reviewed this methodology and recommended some minor changes to improve the accuracy and precision of the calculation, which have been implemented this year.

The following subsection describes the calculation method in detail.

4.1.1 Customer Baseline Load

This methodology develops a baseline energy use by, first, examining the 30 days prior to the event. NYISO holidays in the previous 30 days are excluded; SCR, EDRP or TRDP3 events where the resource was eligible to participate; any days where the resources DADRP bid was accepted; and CHGE dispatch days are excluded.

The next step is to identify the peak load hour within the event period for the previous 30 days. This peak load hour value is multiplied by 25% for an initial value. Low usage days are where the average daily event period usage is less than this initial value. Low usage days are eliminated from consideration in the CBL calculation. Then going backward, the five days with the highest average usage during the event period out of the last ten eligible days are used in the CBL calculation. The simple average of these five days then defines the CBL.

The CBL adjustment factor is calculated using the ratio of the event day load and the average CBL day load the hour prior to an event. The Demand Response (DR) performance is calculated by subtracting the event day load from the adjusted CBL load.

4.1.2 Residential A/C Thermostat Event Day Load Shape, Comparing the 2018 Method vs. the 2019 Method

Figure 11 shows a comparison of the results of the residential A/C thermostat segment for the July 30th event day using the 2019 calculation method and the 2018 calculation method. The solid lines identify the

[1] The contract states that the event hours where the adjusted baseline for thermostats (as computed from the run time reported by the two way communicating thermostats and the connected load as reported by the field install teams) is 2.25 kW or greater will be referred to as Analysis Hours. However, in the 2019 curtailment season this 2.25 threshold was not met on any of the event days. As a result, CH and Itron decided to revert back to the previous evaluation threshold of 93°F.

[2] Customer Baseline Load

[3] New York Independent System Operator, Emergency Demand Response Program Manual, Manual 7, October 2013, p. 5-4.

2019 method and the dashed lines identify the 2018 method. The green-shaded area identifies the event time period, the yellow-shaded area identifies the 2019 adjustment window, and the blue-shaded area identifies the 2018 adjustment window.

The differences between the method used in 2018 and the method used in 2019 are:

- this year the previous day is included as a possible baseline day (last year it was not included)
- this year the adjustment window is the hour prior to the event (as opposed to last year where it was 2 to 4 hours prior)

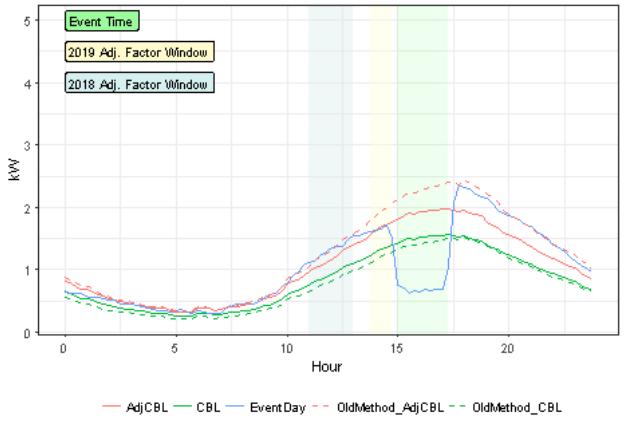

Figure 11: Comparison of Calculation Methods for Residential Thermostat M&V Load July 30, 2019

4.2 C&I (Large Commercial)

This section describes the method used to evaluate the 2019 impact of the load curtailment events for the C&I participant population. The C&I participants agree to provide 4 hours of curtailment for typical demand response events and up to 8 hours of curtailment for special emergency situations that could result from extreme circumstances, including but not limited to, temperature exceeding 95°F, temporary loss of distribution infrastructure, or temporary loss of transmission infrastructure.

4.2.1 C&I Customer Baseline Load

The Customer Baseline Load (CBL) is calculated in the same manner as detailed in *Section 4.1.1*. If the C&I participant has selected a weather-adjusted CBL, then a weather adjustment factor is applied to the average CBL.

For each C&I participant, the Demand Response (DR) performance is calculated by subtracting the event day load from the adjusted CBL load. The entire portfolio performance is the sum of the individual C&I participant performance values for each hour.

The seasonal performance is determined as follows:

- If an event is 4 hours or less, all hours from the event are included in the seasonal performance.
- If an event exceeds 4 hours, the 4 consecutive rolling hours (240 contiguous minutes) with the highest total Itron portfolio performance value is included in the seasonal performance.

The seasonal performance for an individual participant is the average of the hourly performance values over all event hours as described above. In the case where no events have occurred during the event season, the last test hour are applied.

5 Overall M&V Process

5.1 Standard M&V Process

This section describes the processes performed or supported by Itron's Strategic Analytics department in the operations of residential and commercial Demand Response (DR) programs. The processes are divided into three top-level processes as illustrated by *Figure 12* and described in more detail in this section. This is a continuous process as the Strategic Analytics team rolls immediately from reporting of the previous seasons results to the preparations for the next season.

Figure 12: Strategic Analytics Continuous Annual Process

5.1.1 Pre-Season Preparations

In the pre-season, Strategic Analytics prepares for Demand Response (DR) operations and measurement and verification of the performance of the curtailment devices. Strategic Analytics oversees the pre-season tests that are performed by the field teams and the Solution Operations Center (SOC). Strategic Analytics reviews the data collected by the SOC team to ensure that it is accurately captured in IntelliSOURCE. Strategic Analytics verifies that the curtailment strategy assignment reaches each device and that the equipment size is accurately recorded in IntelliSOURCE. These data need to be correct in both IntelliSOURCE and at the device as accurate data is essential to evaluating DR performance.

The communications infrastructure is another component that is evaluated in the pre-season. Strategic Analytics has developed simulation tools and field test procedures to assess the performance of the RF systems upon which the paging curtailment devices depend on to transmit load data and receive curtailment messages. The field staff implements study plans to measure paging signal strength throughout the program areas.

In the pre-season, Strategic Analytics also examines changes in the population since the previous season. As the installed population changes, the system performance can be impacted for better or worse by changes to the mix of customers. Parameters such as customer lifestyle attributes, equipment size, equipment type, dwelling type, and geography can affect the available curtailment load and potential DR performance.

Another pre-season activity is the design and deployment of the M&V sample for one-way devices. For residential A/C DCUs (which have one-way communication), a sample is selected from the participant population. The sample is selected in a way that represents the region, A/C size, and curtailment strategy distribution of the participant population. The selected sample has an Insights+ AMI meter installed to collect whole home energy usage on event and non-event days.

Performing as much testing as possible in the pre-season is an important element of a successful in-season operation. Strategic Analytics works with the SOC to define the tests and provide assistance to correct any issues.

Table 18 outlines the pre-season preparations.

Table 18: Strategic Analytics Pre-Season Preparations

Title	Subtitle
Determine M&V Participants	
	Investigate Alternative Sample Approaches
	Document Removal and Install Requirements
	Create Participant Solicitation/Removal Lists
	Create M&V Plan
	Review with Client and Obtain Agreement
Support M&V Equipment Installation	
	Provide Stratified Participant Lists for Insights+ Installations
	Update IntelliSOURCE
System Configuration	
	Define/Update Curtailment Strategies
	Define/Update IntelliSOURCE Customer Data Configuration
	Verify Data Imports
	Reprogram Population
Initial Data Collection & Verification	
	End Point Communications Verification
	Operational Availability
	Energy Data Collection Verification
	RF Field Study
System Readiness Test	
Estimate Load Reduction Potential	
Client Training	

5.1.2 In-Season Operations

The in-season operations focus on anticipating, identifying and resolving potential issues as well as reporting on event day performance. The Strategic Analytics team works closely with the SOC and the field teams to ensure that DR events operate as expected, required telemetry and AMI data are collected accurately and on schedule, and results are compared and validated with other available information.

An ongoing task throughout the year is verifying the M&V configuration in IntelliSOURCE and assuring that all the information has been entered correctly. For instance, for a participant segment where DR is measured by comparing a group that is curtailed with one that is not curtailed, an accurate result depends on having each of these groups correctly configured in IntelliSOURCE.

During the curtailment season, it is critical to verify and validate the data collected. Throughout the season, the Strategic Analytics team monitors the data collected to check for accuracy and availability. If the data collected from a two-way device is interrupted, field staff may be requested to investigate. Sources of data that are monitored for thermostats and pool pumps include the run-time data, switch or thermostat response, opt out reports, and inspection data. Sources of data that are monitored for the A/C DCUs and whole home generators include the AMI data, switch response, opt out reports, and inspection data.

Monitoring DR events throughout the season is important. The Strategic Analytics team serves as the tier two support for the SOC. In this role, they respond to issues relative to communications system operations and software operations. During the season, Strategic Analytics typically interacts with the SOC several times per day.

Event reporting and analysis are key activities during the curtailment season. For each event, an analysis is performed to determine the load reduction observed. The estimate of the load reduction value is calculated based on each event. At the end of the season a comprehensive review is completed which looks at all the data for each event.

From both the telemetry data and the AMI data, the number of switches or thermostats that curtail as expected and those that do not is recorded. Root cause analysis is performed, and operational changes are implemented as warranted.

Event reports are provided to the program managers and the clients as needed to support outside processes. These reports typically contain the kW reduction per device for each segment, summaries of the curtailment strategy, weather, and the analysis approach.

Finally, the in-season operations are completed based on the program requirements. Immediately thereafter, the focus transitions to the post-season analysis.

Table 19 outlines the in-season operations.

Table 19: Strategic Analytics In-Season Operations

Title	Subtitle
Verify Implementation of Sample Plan	
	Verify All Stratum Are Correctly Represented
	Check That Groups Are Balanced
	Monitor/Replace Deactivations
Verify Data	
	Evaluate Operational Availability
	End Point Communications Verification
	Energy Data Collection Verification
Timely Estimation of Load Reduction	
	Compute Baseline
	Project Curtailment Profile
Determine Events	
	Monitor Weather Data
	When to Curtail
	How Much to Curtail
Analyze Event Results	
	Check Individual End Point Curtailment Profiles
	Check Individual Energy Profiles
Publish Event Results	

5.1.3 Post-Season Analysis

In the post-season, the individual curtailment reports that were prepared throughout the season are integrated. Data are checked for accuracy and field visits are performed to collect any missing data.

A final report and a summary presentation are prepared for the program. This is typically delivered in person to the client. After review and resolution of any questions or concerns, client approval is obtained which permits invoicing for the season and publication of the results.

Table 20 outlines the post-season analysis.

Table 20: Strategic Analytics Post-Season Analysis

Title	Subtitle
Analyze Data & Events	
	End of Season Estimation of Load Reduction
	Field Verification
Verify Data	
	Operational Availability
	End Point Communications Verification
	Energy Data Collection Verification
Evaluation Report	
	Compute kW Factors
	Compute MW Availability for Program
	Ancillary Analysis
	Report to Itron Finance
	Report to Client
Client Signoff	

5.2 Process Tailoring

Table 21 indicates the applicability of each process to the Peak Perks program.

Table 21: Process Tailored to CenHub Peak Perks Program

Process	Title	Applicability to Program
Pre-Season Preparations		
	System Configuration	Solutions Operations Center
	Initial Data Collection & Verification	Solutions Operations Center
	System Readiness Test	Solutions Operations Center
	Estimate Load Reduction Potential	Strategic Analytics
	Client Training	Solutions Operations Center
In-Season Operations		
	Verify Data	Solutions Operations Center
	Timely Estimation of Load Reduction	Strategic Analytics
	Determine Events	Strategic Analytics
	Analyze Event Results	Strategic Analytics
	Publish Event Results	Strategic Analytics
Post-Season Analysis		
	Analyze Data & Events	Strategic Analytics
	Verify Data	Solutions Operations Center
	Evaluation Report	Strategic Analytics
	Client Signoff	Strategic Analytics

6 Sample Plan

In the first quarter of 2019, Itron provided the sample plan that is presented in this section, which describes the plan for obtaining a sample of enrolled premises for the residential A/C DCU population for the 2019 curtailment season. To represent the population as closely as possible, participants were stratified by region, number of A/Cs, and tonnage per premises as explained in *Section 2*.

6.1 Residential A/C DCU (One-Way Devices)

Starting in 2017, Itron began to collect whole home energy usage from Insights+ electric meters on a sample of residential participants that have an A/C with a DCU. The distribution of the participant population as of December 31, 2018 and the sample distribution are shown in *Tables 22 through 24*. Note that tonnage is averaged for premises with more than one A/C.

Table 22: Residential A/C DCU Participant Population and Proposed Sample Distribution - 50% Curtailment Strategy

Region	Num ACs	Tonnage Bin	Pop Count	Pop Percent	Sample Count	Sample Percent
Fishkill	1	<3.0	185	0.09	18	0.09
Fishkill	1	=3.0	206	0.10	20	0.10
Fishkill	1	>3.0	296	0.14	28	0.14
Fishkill	2+	<3.0	111	0.05	11	0.06
Fishkill	2+	=3.0	65	0.03	6	0.03
Fishkill	2+	>3.0	111	0.05	11	0.06
Merritt Park	1	<3.0	31	0.01	3	0.02
Merritt Park	1	=3.0	31	0.01	3	0.02
Merritt Park	1	>3.0	19	0.01	2	0.01
Merritt Park	2+	<3.0	24	0.01	2	0.01
Merritt Park	2+	=3.0	8	0.00	1	0.01
Merritt Park	2+	>3.0	11	0.01	1	0.01
NW Corridor	1	<3.0	289	0.14	28	0.14
NW Corridor	1	=3.0	174	0.08	17	0.09
NW Corridor	1	>3.0	127	0.06	12	0.06
NW Corridor	2+	<3.0	54	0.03	5	0.03
NW Corridor	2+	=3.0	13	0.01	1	0.01
NW Corridor	2+	>3.0	10	0.00	1	0.01

Table 23: Residential A/C DCU Participant Population and Proposed Sample Distribution - 75% Curtailment Strategy

Region	Num ACs	Tonnage Bin	Pop Count	Pop Percent	Sample Count	Sample Percent
Fishkill	1	<3.0	15	0.01	1	0.01
Fishkill	1	=3.0	14	0.01	1	0.01
Fishkill	1	>3.0	28	0.01	3	0.02
Fishkill	2+	<3.0	14	0.01	1	0.01
Fishkill	2+	=3.0	9	0.00	1	0.01
Fishkill	2+	>3.0	8	0.00	0	0.00
Merritt Park	1	<3.0	2	0.00	0	0.00
Merritt Park	1	=3.0	5	0.00	0	0.00
Merritt Park	1	>3.0	3	0.00	0	0.00
Merritt Park	2+	<3.0	6	0.00	1	0.01
Merritt Park	2+	=3.0	1	0.00	0	0.00
Merritt Park	2+	>3.0	1	0.00	0	0.00
NW Corridor	1	<3.0	63	0.03	6	0.03
NW Corridor	1	=3.0	36	0.02	4	0.02
NW Corridor	1	>3.0	33	0.02	3	0.02
NW Corridor	2+	<3.0	17	0.01	2	0.01
NW Corridor	2+	=3.0	2	0.00	0	0.00
NW Corridor	2+	>3.0	3	0.00	1	0.01

Table 24: Residential A/C DCU Participant Population and Proposed Sample Distribution - 100% Curtailment Strategy

Region	Num ACs	Tonnage Bin	Pop Count	Pop Percent	Sample Count	Sample Percent
Fishkill	1	<3.0	8	0.00	1	0.01
Fishkill	1	=3.0	8	0.00	0	0.00
Fishkill	1	>3.0	11	0.01	1	0.01
Fishkill	2+	<3.0	9	0.00	1	0.01
Fishkill	2+	=3.0	4	0.00	0	0.00
Fishkill	2+	>3.0	3	0.00	0	0.00
Merritt Park	1	<3.0	0	0.00	0	0.00
Merritt Park	1	=3.0	0	0.00	0	0.00
Merritt Park	1	>3.0	1	0.00	0	0.00
Merritt Park	2+	<3.0	1	0.00	0	0.00
Merritt Park	2+	=3.0	2	0.00	0	0.00
Merritt Park	2+	>3.0	0	0.00	0	0.00
NW Corridor	1	<3.0	6	0.00	1	0.01
NW Corridor	1	=3.0	4	0.00	1	0.01
NW Corridor	1	>3.0	4	0.00	1	0.01
NW Corridor	2+	<3.0	3	0.00	0	0.00
NW Corridor	2+	=3.0	0	0.00	0	0.00
NW Corridor	2+	>3.0	1	0.00	0	0.00

7 Deployed Sample

For one-way devices, the M&V requirements for the Peak Perks program call for a statistically valid sample of M&V sites to be used to calculate the load impact estimate for the entire enrolled population. The agreed to 2019 sample plan included 200 residential A/C DCU sites as presented in *Section 6*. As of the beginning of June 1, 2019, the residential A/C DCU participant list is shown in *Table 25*.

Table 25: 2019 Residential A/C DCU Sample Sites

Premises ID	Premises ID	Premises ID	Premises ID	Premises ID	Premises ID
0000299644	0000316160	0000308206	0000191326	0000204510	0000302289
0000318118	0000309813	0000308210	0000323296	0000204528	0000028974
0000054128	0000329966	0000188541	0000323307	0000204858	0000024364
0000072451	0000176743	0000324124	0000318205	0000204942	0000025786
0000312184	0000176642	0000177561	0000330441	0000204950	0000025784
0000075453	0000177037	0000188821	0000325381	0000205063	0000331035
0000066020	0000177131	0000177564	0000191782	0000205570	0000306549
0000065963	0000177353	0000300420	0000191800	0000319612	0000296601
0000066207	0000177686	0000300426	0000191866	0000205765	0000026886
0000068169	0000187599	0000189166	0000360109	0000205840	0000028203
0000056705	0000306989	0000348369	0000192324	0000206194	0000018446
0000070312	0000312604	0000357431	0000192505	0000318742	0000312931
0000357763	0000187649	0000189818	0000192585	0000360273	0000014509
0000324027	0000301300	0000189912	0000192608	0000317960	0000024117
0000351426	0000309050	0000190446	0000193208	0000335021	0000029285
0000068459	0000322319	0000190765	0000193266	0000217741	0000360200
0000094950	0000322337	0000310005	0000193616	0000217890	0000065919
0000088794	0000322339	0000190908	0000202869	0000348367	0000067245
0000088212	0000322347	0000190937	0000202880	0000004244	0000326363
0000089113	0000322356	0000190969	0000203222	0000005630	0000068249
0000088946	0000322510	0000191089	0000344754	0000023377	0000092856
0000091374	0000322522	0000356872	0000344762	0000023356	0000088598
0000302907	0000322524	0000356873	0000203732	0000023136	0000055602
0000334353	0000322567	0000356877	0000203878	0000362491	0000322482
0000091588	0000306226	0000356882	0000203955	0000018150	0000187770
0000315423	0000312096	0000356894	0000299209	0000321433	0000188202
0000098317	0000188021	0000356896	0000299639	0000014158	0000188324
0000091232	0000188052	0000356905	0000299656	0000329425	0000206255
0000090669	0000188191	0000356906	0000204195	0000009487	0000218837
0000094433	0000188195	0000191196	0000204440	0000324887	

AMI data is also collected for evaluating the whole home generators. Insights+ electric meters are being installed as customers enroll in the whole home generator program. As of the beginning of June 1, 2019, the list of residential whole home generator participants with Insights+ electric meters is shown in *Table 26*.

Table 26: 2019 Residential Whole Home Generator Sample Sites

Premises ID	Premises ID	Premises ID	Premises ID	Premises ID	Premises ID
0000013294	0000192431	0000206364	0000218720	0000313266	0000322568
0000068174	0000194482	0000207001	0000218828	0000318733	0000347979
0000187982	0000204331	0000207306	0000306801	0000322359	0000359240
0000192323	0000204871	0000217785			

For air conditioner and pool pump two-way devices, no sample is needed as data used to calculate the load impact is collected from all participants through their control device.

Figure 13 shows a map of the Peak Perks program area and the M&V site locations for residential A/C DCU participants. Yellow colored circles show the 2019 Peak Perks participant installations, while the red circles represent the M&V sites.

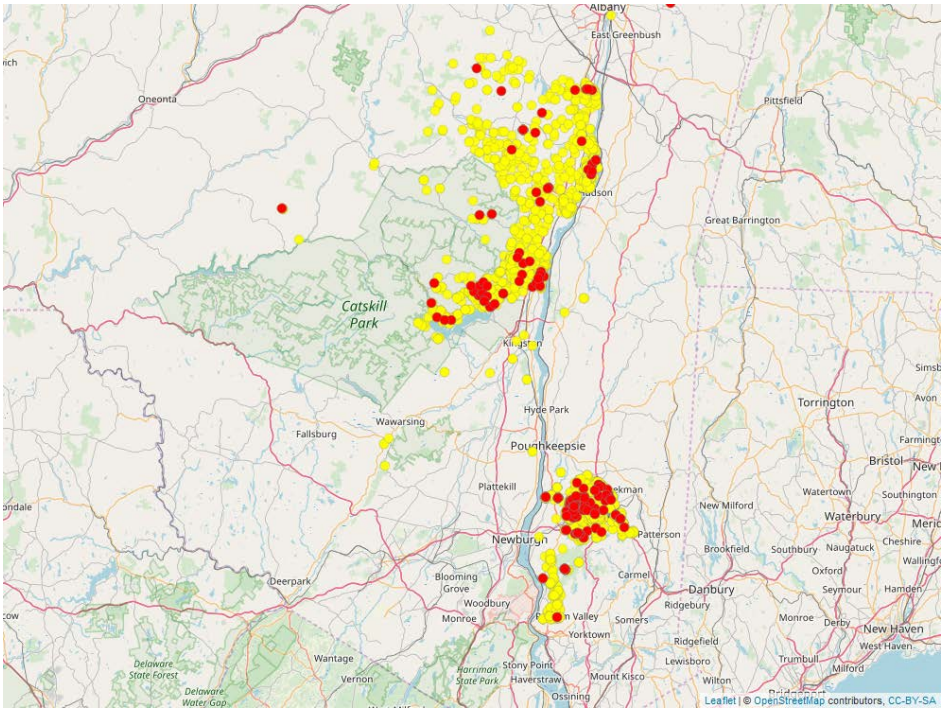

Figure 13: Peak Perks Program Residential A/C DCU M&V Sample

8 Adjustments to Sample

8.1 Types of Adjustments

During the curtailment season, the number of M&V participants fluctuates. Listed below are the possible reasons for the changes in the M&V sample:

- Install - A new customer is recruited as an M&V customer and M&V equipment is installed on the premises
- Reactivate - A premises already is equipped with M&V equipment; however, it needs to be activated because a new customer moves in.
- Disconnect - A customer moves out of an M&V premises and the equipment is left on site. This is common for Multi-Dwelling Units (MDUs) or apartments. The M&V site can be reactivated if a new customer moves in and signs up for the program.
- Deactivate/Removal - A customer exits the program (program optout) or moves out of a residence. The M&V equipment is typically removed from the premises after a deactivation.

8.2 Curtailment Season Adjustments

Table 27 documents the changes to the DCU M&V population during the 2019 curtailment season.

Table 27: Adjustments to the Residential A/C DCU M&V Sample During the Curtailment Season

Premises ID	Notes	Start Date	Stop Date
0000202869	No meter data after 06/14/19	06/01/19	06/14/19
0000321433	No meter data after 07/31/19	06/01/19	07/31/19
0000014158	No meter data after 07/31/19	06/01/19	07/31/19
0000028203	No meter data after 08/27/19	06/01/19	08/27/19
0000176642	Deactivated	06/01/19	07/03/19
0000312604	Deactivated	06/01/19	07/03/19
0000193266	Deactivated	06/01/19	07/12/19
0000318742	Deactivated	06/01/19	08/16/19
0000091232	Deactivated	06/01/19	08/28/19
0000024364	Deactivated	06/01/19	09/10/19
0000028974	Deactivated	06/01/19	09/12/19
0000068459	Deactivated	06/01/19	09/18/19
0000094433	Opted out	06/01/19	07/25/19
0000347905	New AMI meter installation	06/04/19	09/30/19
0000001370	New AMI meter installation	06/06/19	09/30/19
0000090369	New AMI meter installation	06/06/19	09/30/19
0000038235	New AMI meter installation	06/06/19	09/30/19
0000090458	New AMI meter installation	06/07/19	09/30/19
0000025001	New AMI meter installation	06/14/19	09/30/19
0000206595	New AMI meter installation	07/22/19	09/30/19

Table 28 documents the changes to the list of whole home generator with Insights+ electric meters during the 2019 curtailment season.

Table 28: Adjustments to the Residential Whole Home Generator M&V Sample During the Curtailment Season

Premises ID	Notes	Start Date	Stop Date
0000218828	Opted out	06/01/19	06/27/19
0000322568	Opted out	06/01/19	08/01/19
0000306801	Opted out	06/01/19	08/02/19
0000204331	Opted out	06/01/19	08/09/19
0000018687	New AMI meter installation	09/16/19	09/30/19
0000322322	New AMI meter installation	09/16/19	09/30/19
0000332326	New AMI meter installation	09/16/19	09/30/19
0000330569	New AMI meter installation	09/17/19	09/30/19
0000094534	New AMI meter installation	09/20/19	09/30/19
0000190911	New AMI meter installation	09/24/19	09/30/19
0000207644	New AMI meter installation	09/25/19	09/30/19
0000218251	New AMI meter installation	09/25/19	09/30/19
0000346114	New AMI meter installation	09/26/19	09/30/19

9 Measurement Activities

9.1 Data Sources and Uses

The M&V evaluation utilizes several data sources to monitor, analyze, and forecast load. The IntelliSOURCE server is used to collect data on the appliance runtime and the appliance connected load for the two-way devices. During the 2019 Curtailment Season, information from the two-way devices is sent to the database every day and contain data in 5-minute increments. R (a language and environment for statistical computing) is used to download and store data that is posted from the Insights+ electric meters. R is also used for all data analysis.

In addition to these databases, Strategic Analytics uses external data sources to monitor weather and system load. Since temperature at the time of a curtailment event is an important factor for DR performance reporting, Strategic Analytics utilizes the US Government NOAA forecast weather data for official temperature information. R is used to view and process the weather data.

9.1.1 Residential and Small Commercial Two-Way Device Participants (A/Cs with a Smart Thermostat and Pool Pumps with a DCU)

For all of the A/C smart thermostat two-way device participants and all of the pool pump participants, data is collected on the runtime of the appliance and the connected load of the appliance.

The two-way control devices record and report the time during which the appliance is running, which is referred to as runtime. The accumulated runtime is recorded in integer minutes. This information is transmitted to the IntelliSOURCE system and stored in a database. For A/Cs, the indoor temperature and the working set point are also transmitted to IntelliSOURCE. IntelliSOURCE calculates the five-minute interval runtime by differencing the accumulated runtime between successive five-minute data intervals. This information is multiplied by the connected load to calculate the kW energy usage for each five-minute interval.

The connected load values are estimated based on the equipment name plate information collected by the field technician. The field technician records, when available, the manufacturer, make, model, and manufacture year. Additionally, for each A/C, the A/C size (typically in BTU/hr or A/C tons), the A/C load amps, and the fan load amps are captured; for pool pumps, the horsepower is recorded.

9.1.2 Residential and Small Commercial One-Way Device Participants (A/Cs with a DCU)

In the Peak Perks program, digital control units (DCU) with one-way paging capability are currently deployed for the DR curtailment of air conditioning units at locations where Wi-Fi thermostats cannot be installed and operated, or when the participant prefers a DCU. These units are not capable of communicating load data. To estimate residential DR reductions, Insights+ electric meters were deployed on a representative sample of 200 residential premises with one-way paging digital control units (sample group). These meters provide 15-minute interval whole home kW usage data which is downloaded from a third-party system and analyzed to estimate the mean kW reductions for the residential digital control unit participant population. The estimated reduction for the small commercial DCU population is based on the relationship of residential thermostat to DCU savings per ton (i.e. SmallCommTstat/Ton * [(ResDCU/Ton)/(ResTstat/Ton)]*SmallCommDCU_AveTon).

9.1.3 Whole Home Generator (WHG) Participants

Central Hudson Gas and Electric deployed Insights+ electric meters for the enrolled whole home generator program participants. These meters provide 15-minute interval whole home kW usage data which is downloaded from a third-party system and analyzed to calculate the mean kW reductions for the residential whole home generator participant population.

9.1.4 C&I (Large Commercial) Participants

Central Hudson Gas and Electric provides 15-minute interval data to Itron for all participants enrolled in the program under the C&I segment. Itron provides the interval data to the C&I vendors and they calculate the load reduction results.

9.2 Hourly Weather Data

Since temperature at the time of a curtailment event is an important factor for DR performance reporting, Strategic Analytics utilizes the US Government NOAA forecast weather data for official temperature information. These data help to forecast load and determine the possibility of a load curtailment event taking place. Research is done on the relationship between temperature and load in order to make the decision to call a curtailment event. Recorded temperature is used from the following weather stations: KPOU station (Poughkeepsie, Dutchess County Airport) for Fishkill/Shenandoah, KSWF station (Newburgh / Stewart) for Merritt Park, and KALB station (Albany International Airport) for Northwest Corridor.

Figure 14 shows the daily temperature extremes recorded at the area NOAA weather station KPOU from June 1, 2019 to September 30, 2019. The red triangles mark days selected to be curtailment event days.

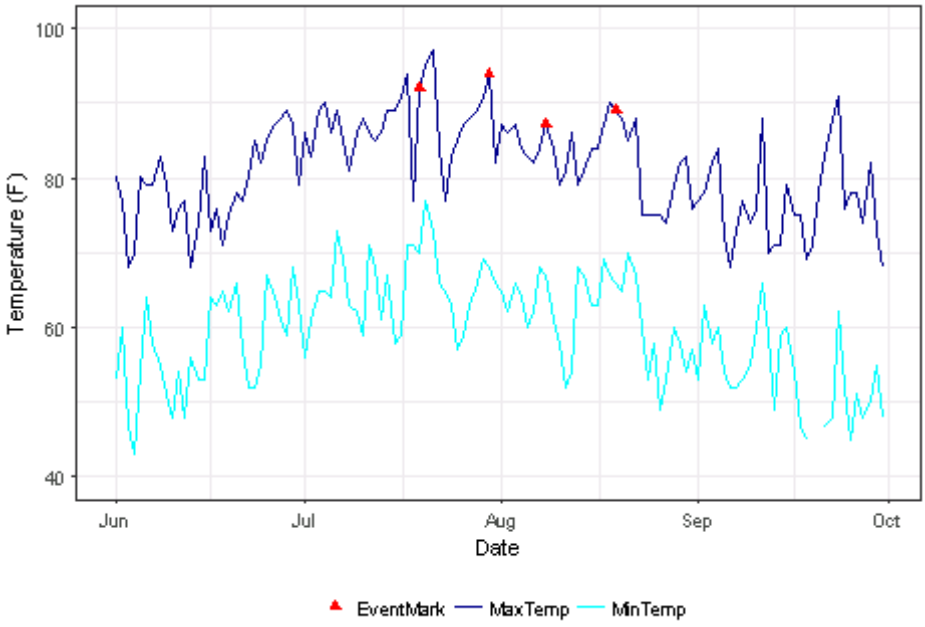

Figure 14: Maximum Recorded Temperatures at KPOU Weather Station

10 Exception Handling

This section describes the circumstances when either an adjustment of load data used for reduction calculations is needed or when a technician visit is needed to verify data. As summarized in *Section 9*, the Solutions Operations Center monitors, validates, and maintains the quality of data. This process may require a field visit by an Itron technician. When a field visit is conducted, technicians verify that the equipment information are correctly listed in the Itron database. Any differences are updated when found.

This section has a brief description of how the Solutions Operations Center remedies each situation in a manner that best estimates the equipment performance of the participant population.

10.1 Data Validation

For two-way devices, each 5-minute interval runtime is validated and assigned a value, designating if there is an error in reading the data for that interval.

Any data missing over multiple intervals might be the result of:

- Wi-Fi issue at customer location that prevents the smart thermostat from reporting,
- an issue in IntelliSOURCE that prevents data from being stored,
- a customer leaving the program and their device has been deactivated,
- a problem with the wiring between the thermostat/switch and the equipment, or
- a thermostat device failure.

If the customer has left the program, any data collected after the deactivation dates are not counted toward DR reduction analysis. If there is a problem with the wiring between the thermostat/switch and the equipment, a technician goes on-site to fix the connection.

For Insights+ electric meter data, a status value is created with each interval reading. Readings with invalid status values are not counted toward DR reduction analysis.

For C&I participants, the meter data provided by CHGE is already validated and any missing intervals have been estimated.

10.2 Data Verification

Occasionally, the Solutions Operations Center finds that certain sites never report zero loads in any interval. In this case, the Solutions Operations Center calculates the minimum load reading reported for those sites over the course of the curtailment season. In most cases, the load will be between 0.01 and 0.30 kW. If substantial load is always found at the site, the Solutions Operations Center dispatches a technician to verify that the equipment is wired and functioning properly and that the equipment is running during the entire time they are there. It is Itron policy to leave this data as is unless an incorrect wiring problem is found. In that case, a technician goes on-site to fix the wiring problem and the prior data is removed.

11 Communications Analysis

11.1 DR Network Messaging Service Provider

Itron has contracted with Central Vermont Communications (CVC) for messaging services, at a carrier frequency of 157.74 MHz, for the Central Hudson Peak Perks program. CVC serves the northeastern United States including Vermont, New Hampshire, Massachusetts, Connecticut, and western Maine with extended coverage in Eastern New York, Eastern Pennsylvania, New Jersey, and Delaware as is presented in *Figure 15*.

Figure 15: Central Vermont Communications Paging Service Area

11.2 Remote Terminal Monitoring

Near real time performance of the Itron RF paging network is monitored using Remote Terminal Monitor (RTM) paging receivers. RTMs provide verification that a valid message has been transmitted on the RF paging network. All valid messages that are received by the RTM are recorded and reported back to the IntelliSOURCE server. A typical RTM log is presented in *Figure 16*.

FIGURE DELETED

Figure 16: FIGURE REDACTED

11.3 RF Coverage Simulation

A typical RF signal coverage model for this DR program is presented in *Figure 17*. This model is developed, and maintained using EDX SignalPro, an RF simulation wireless network engineering software package. The model is utilized to estimate signal availability over the DR coverage area.

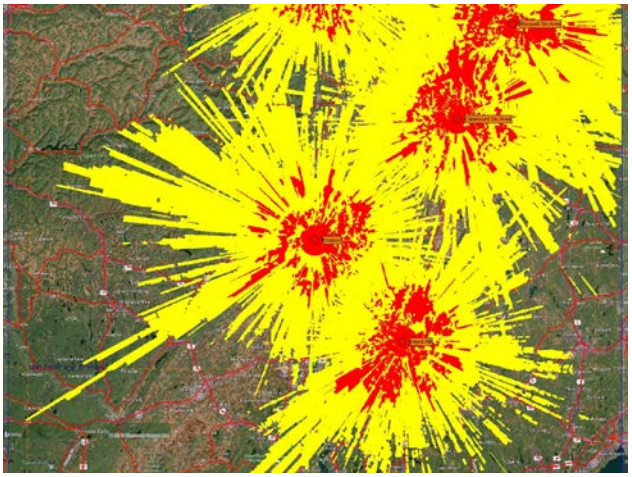

Figure 17: RF Coverage Map for Paging System

11.4 DR Network Performance Maintenance

Additionally, Strategic Analytics conducts annual RF coverage field studies. The purpose of the yearly field test is to evaluate the RF signal quality in the DR service area. The field test is conducted using an RF spectrum analyzer with an Itron DCU used to monitor message decoding when necessary. The test network is shown in *Figure 18*. The arrows in the figure show the direction of the paging messages.

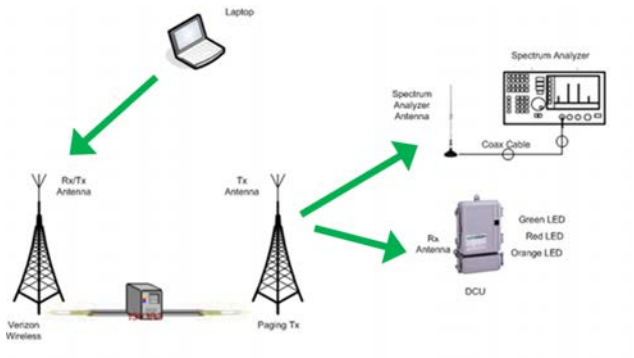

Figure 18: Network Testing

The locations selected for measuring RF paging signal strength depend on the utility company's service territory, house density, the surrounding terrain and access to the community (residential areas, etc.). Following are location selection guidelines:

- To verify signal levels from RF VHF paging transmitter towers measurements are conducted as close as possible to selected Itron DR curtailment installation sites.
- For hilly and mountainous terrains, receive signal strength is taken at different locations depending on paging tower location.
- Multiple test pages are transmitted and the receive success rate is recorded.
- Tower locations and measurement locations are determined using a GPS receiver and map coordinates. All measurement location LATITUDE and LONGITUDE coordinates are accurately recorded and referenced to the corresponding measurement file.

A typical paging signal RF spectrum analyzer measurement collected from a location in the program area is shown in *Figure 19*. The figure presents the frequency domain trace of a paging message captured using an Agilent spectrum analyzer. The trace is centered on the frequency of the carrier frequency. There are well-defined peaks on either side of the carrier frequency and present a well-formed signal.

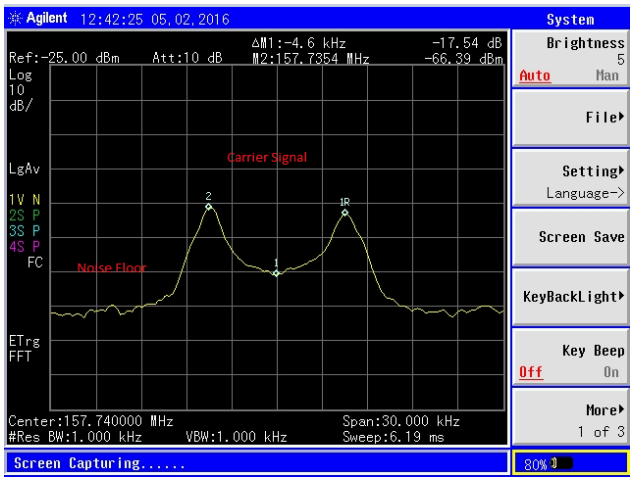

Figure 19: RF Signal Measurement- Spectrum Analyzer Trace

A table of the most recent receive signal strength (RSSI) results of a Spring 2019 field study is detailed in *Table 29*.

Itron Proprietary Information Deleted.

Table 29: Paging Field Study

Site	Measured RSSI (dBm)	Messages Sent	Messages Received
1	no signal	2	0
2	no signal	2	0
3	no signal	2	0
4	-92	2	0
5	-100	2	0
6	-64	3	2
16	-46	4	4
17	-50	4	4
21	-50	4	4
13	-57	4	4
14	-61	4	4
24	-68	4	4
20	-69	4	4
15	-71	4	4
12	-72	5	4
25	-72	4	4
10	-73	4	4
22	-73	4	4
9	-74	4	4
19	-75	4	4
11	-76	4	4
8	-78	4	4
18	-79	4	4
7	-80	4	4
23	-80	4	4
26	-82	4	4
27	-83	2	0
28	-85	2	0
29	-82	4	2
30	-83	5	2
31	-83	5	3
32	-60	4	4
33	-70	4	4
34	-74	4	4
35	-77	4	4
36	-77	4	4
37	-88	4	4

12 Demand Response Calculations

12.1 Residential / Small Commercial Event Day Details

For the 2019 curtailment season, there was a total of four curtailment event days for residential and small commercial populations, as presented in *Table 30* below. A qualifying curtailment day for the residential and small commercial populations is defined as those days in which there is one or more hours with a temperature at or above 93°F during the event hours. Having a threshold allows for testing to occur on warm days when the system load is not at its peak, without unduly impacting seasonal performance. As shown in *Table 30*, there was one event day with qualifying curtailment hours.

Table 30: Event Dates Summary

Date	Start Time	End Time	Notes	Qualifying Day
07/19/2019	15:00	19:00	Residential Thermostats, Residential DCUs, Pool Pumps, WHGs, Small Commercial Thermostats, Small Commercial DCUs	No
07/30/2019	15:00	17:00	Residential Thermostats, Residential DCUs, Pool Pumps, WHGs, Small Commercial Thermostats, Small Commercial DCUs	Yes
08/08/2019	15:00	19:00	Residential Thermostats, Residential DCUs, Pool Pumps, WHGs, Small Commercial Thermostats, Small Commercial DCUs	No
08/19/2019	17:00	19:00	Residential Thermostats, Residential DCUs, Pool Pumps, WHGs, Small Commercial Thermostats, Small Commercial DCUs	No

12.1.1 Residential A/C Thermostat Event Day Load Shapes

Figure 20 through *Figure 23* show the average event day kW load, the average unadjusted baseline kW load, and the average adjusted baseline kW load for each of the days the residential thermostat segment was curtailed. The green-shaded area identifies the event time period and the yellow-shaded area identifies the adjustment window.

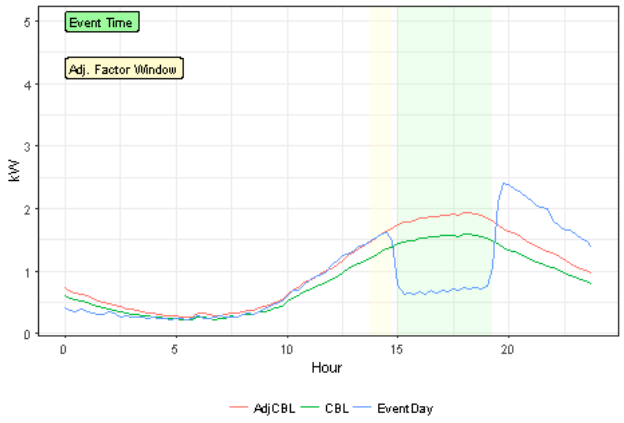

Figure 20: Residential Thermostat M&V Load July 19, 2019

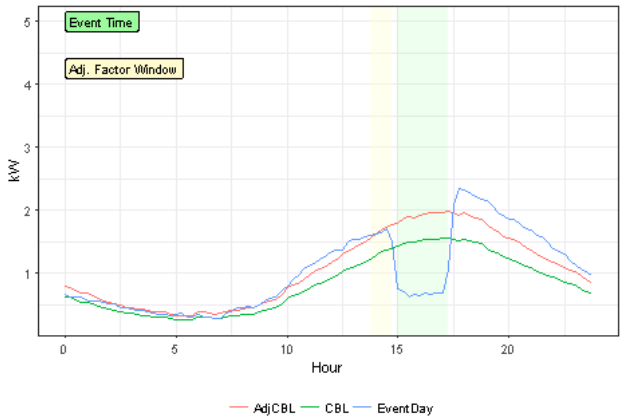

Figure 21: Residential Thermostat M&V Load July 30, 2019

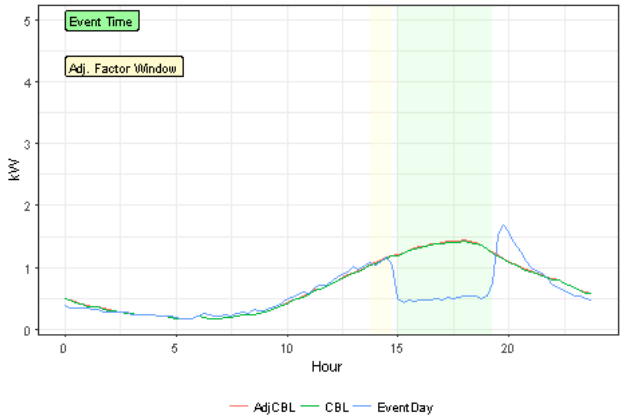

Figure 22: Residential Thermostat M&V Load August 8, 2019

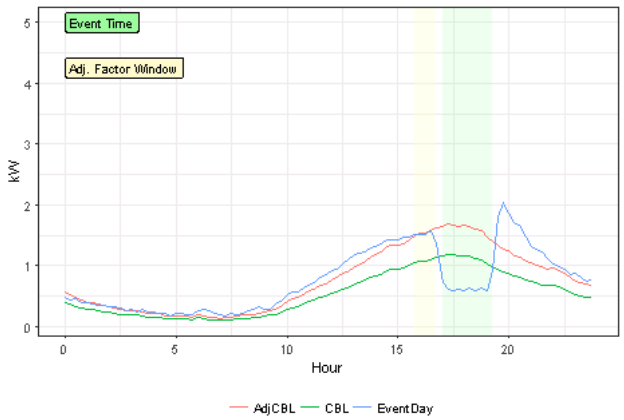

Figure 23: Residential Thermostat M&V Load August 19, 2019

12.1.2 Residential A/C DCU Event Day Load Shapes

Figure 24 through *Figure 27* present the event data for the residential DCU segment.

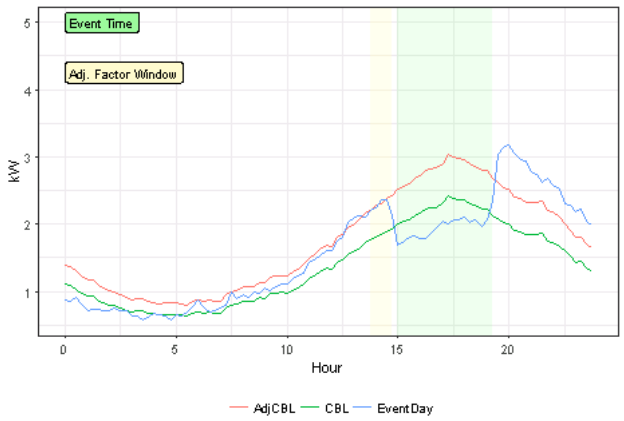

Figure 24: Residential DCU M&V Load July 19, 2019

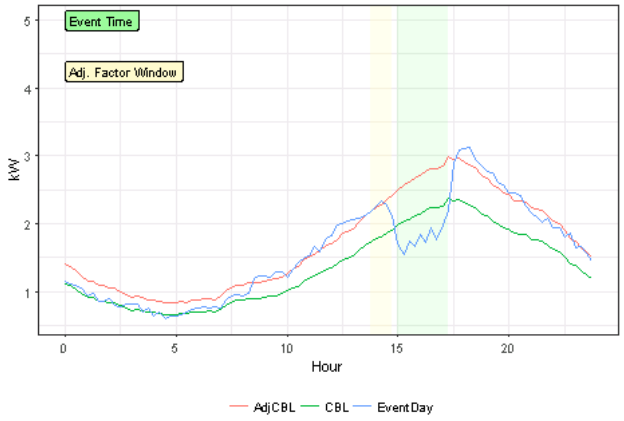

Figure 25: Residential DCU M&V Load July 30, 2019

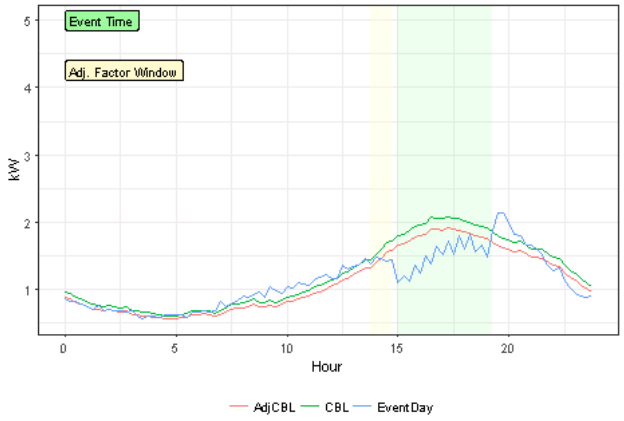

Figure 26: Residential DCU M&V Load August 8, 2019

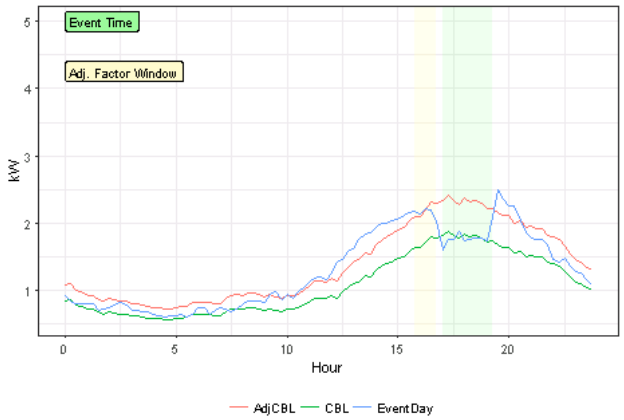

Figure 27: Residential DCU M&V Load August 19, 2019

12.1.3 Residential Pool Pump DCU Event Day Load Shapes

Figure 28 through *Figure 31* present the event data for the residential pool pump segment.

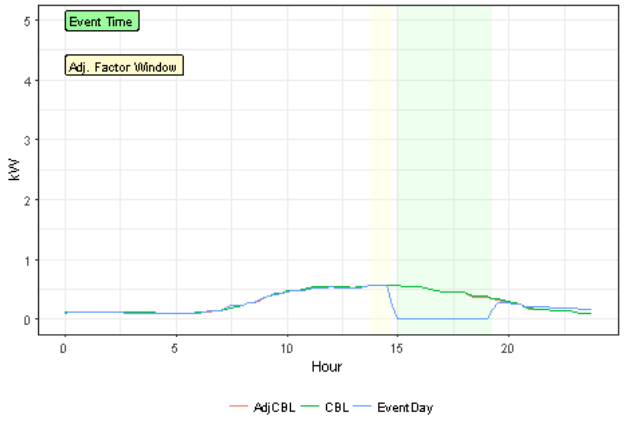

Figure 28: Residential Pool Pump M&V Load July 19, 2019

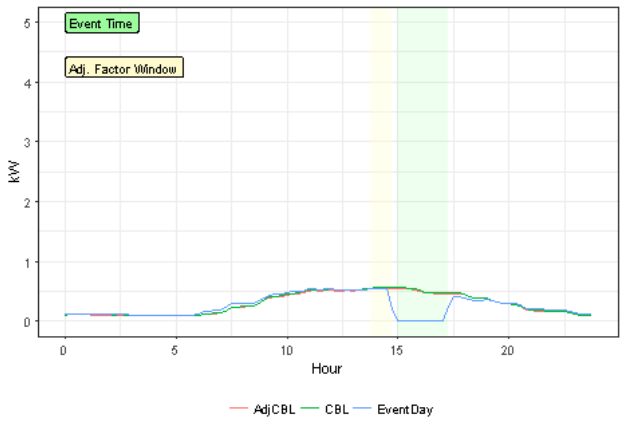

Figure 29: Residential Pool Pump M&V Load July 30, 2019

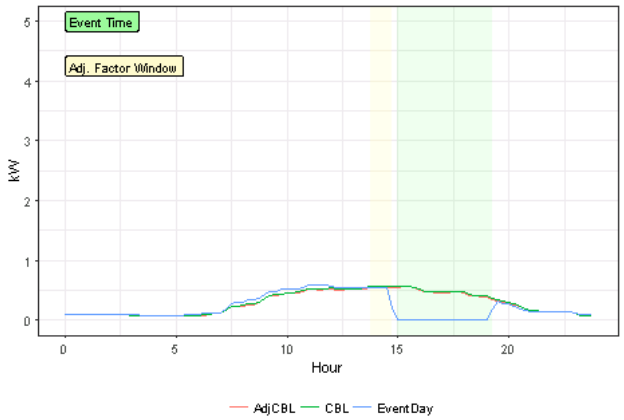

Figure 30: Residential Pool Pump M&V Load August 8, 2019

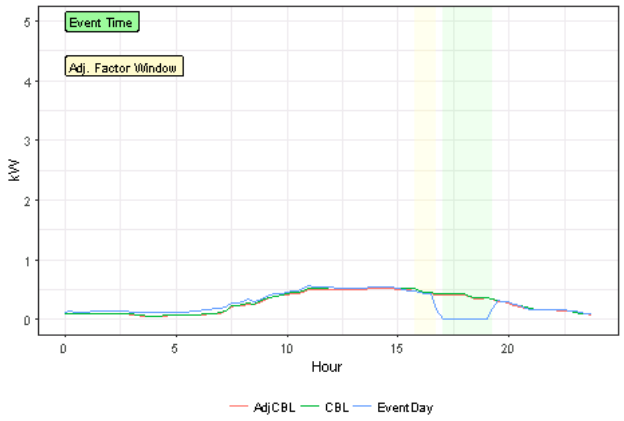

Figure 31: Residential Pool Pump M&V Load August 19, 2019

12.1.4 Residential Whole Home Generator Event Day Load Shapes

Figure 32 through *Figure 35* present the event data for the residential whole home generator segment.

Figure 32: Residential Generator M&V Load July 19, 2019

Figure 33: Residential Generator M&V Load July 30, 2019

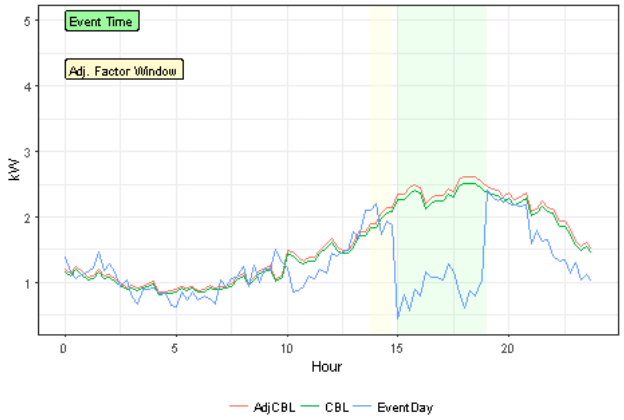

Figure 34: Residential Generator M&V Load August 8, 2019

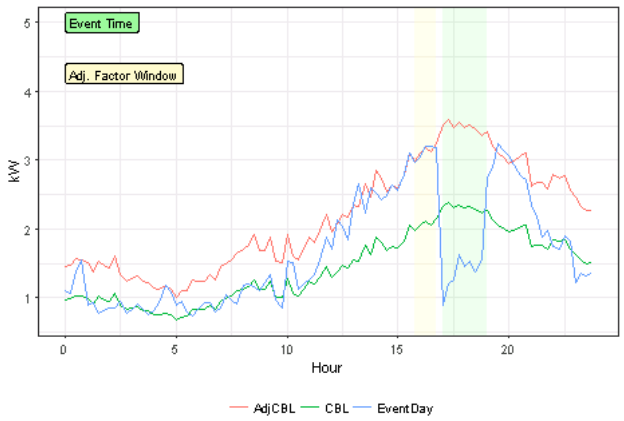

Figure 35: Residential Generator M&V Load August 19, 2019

12.1.5 Small Commercial A/C Thermostat Event Day Load Shapes

Figure 36 through *Figure 39* present the event data for the small commercial thermostat segment.

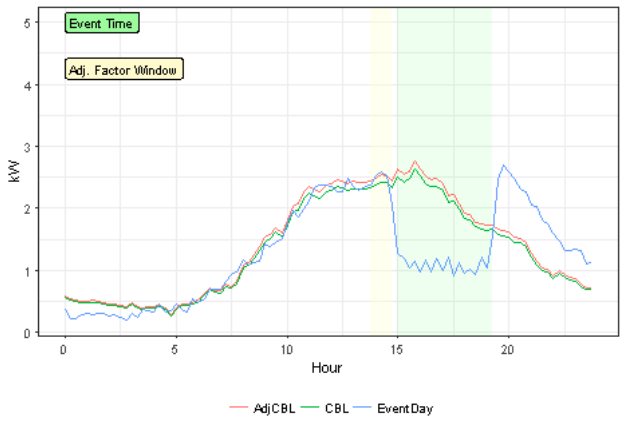

Figure 36: Small Commercial Thermostat M&V Load July 19, 2019

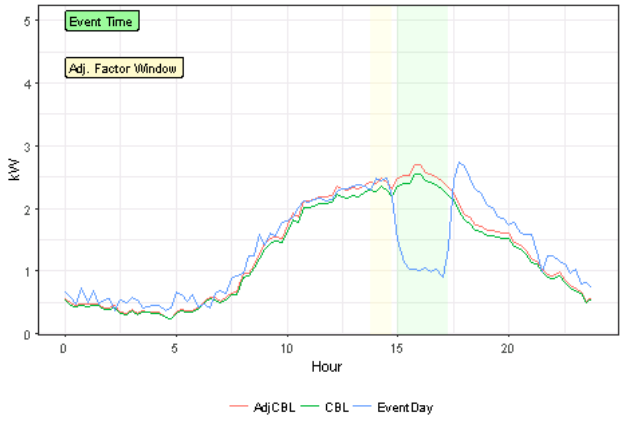

Figure 37: Small Commercial Thermostat M&V Load July 30, 2019

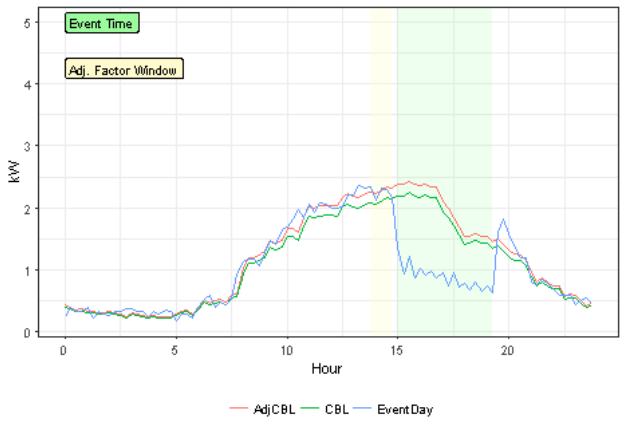

Figure 38: Small Commercial Thermostat M&V Load August 8, 2019

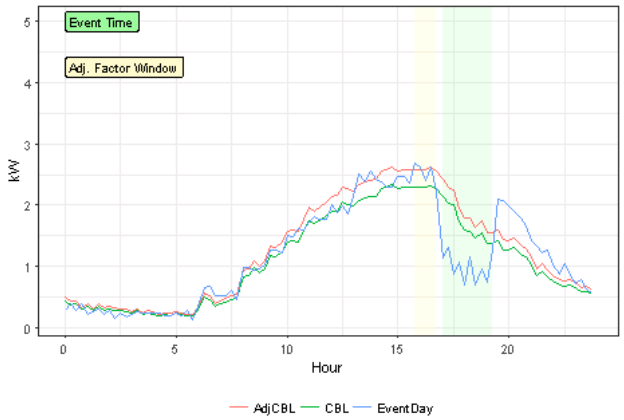

Figure 39: Small Commercial Thermostat M&V Load August 19, 2019

12.2 Residential / Small Commercial Load Reduction Results

The residential and small commercial load reduction estimates in 2019 were calculated for each event initiated by CHGE during the summer. First the load reduction for each 15-minute interval during the event is estimated by taking the difference between the average adjusted baseline and the average event day load for each segment that was curtailed. Then the 15-minute reductions are averaged across the entire event period to estimate the load reduction for each event.

The Strategic Analytics team engaged in a vigorous data validation process and made any necessary adjustments to the data based on blackouts, incorrect wiring, or other scenarios that would affect data quality.

12.2.1 Residential A/C Thermostat Load Reduction Results

Table 31 summarizes the residential thermostat segment load reduction results for each event. Using the adjusted baseline approach, the average reduction per device for the residential thermostat population is 1.23 kW. The numbers presented below include an 88.8%, 89.1%, 87.5%, and 86.4% adjustment for 7/19, 7/30, 8/8, and 8/19 respectively, to account for offline devices that were not curtailed.

Table 31: Residential Thermostat Summary of 2019 Events

TempF	Date	StartTime	EndTime	kW	Qualifying Day
92	07/19/2019	15:00	19:15	1.18	No
93	07/30/2019	15:00	17:15	1.23	Yes
87	08/08/2019	15:00	19:15	0.87	No
88	08/19/2019	17:00	19:15	1.00	No
				1.23	Average Qualifying

12.2.2 Residential A/C DCU Load Reduction Results

Table 32 summarizes the residential A/C DCU segment load reduction results for each event. Using the adjusted baseline approach, the average reduction per device for the residential A/C DCU population is 0.93 kW. The DCU AMI data is collected is per home. The numbers presented below include an adjustment for number of devices per home of 1.24, 1.23, 1.24, and 1.23 for 7/19, 7/30, 8/8, and 8/19 respectively, to convert

the savings to a per device value. An offline adjustment factor is not required since the load associated with a non-curtailed device is included in the whole-home AMI data.

Table 32: Residential DCU Summary of 2019 Events

TempF	Date	StartTime	EndTime	kW	Qualifying Day
92	07/19/2019	15:00	19:15	0.88	No
93	07/30/2019	15:00	17:15	0.93	Yes
87	08/08/2019	15:00	19:15	0.33	No
88	08/19/2019	17:00	19:15	0.57	No
				0.93	Average Qualifying

12.2.3 Residential Pool Pump DCU Load Reduction Results

Table 33 summarizes the residential pool pump segment load reduction results for each event. Using the adjusted baseline approach, the average reduction per device for the residential pool pump population is 0.51 kW. The numbers presented below include an 78.8%, 76.6%, 78.1%, and 78.7% adjustment for 7/19, 7/30, 8/8, and 8/19 respectively, to account for offline devices that were not curtailed.

Table 33: Residential Pool Pump Summary of 2019 Events

TempF	Date	StartTime	EndTime	kW	Qualifying Day
92	07/19/2019	15:00	19:15	0.47	No
93	07/30/2019	15:00	17:15	0.51	Yes
87	08/08/2019	15:00	19:15	0.48	No
88	08/19/2019	17:00	19:15	0.39	No
				0.51	Average Qualifying

12.2.4 Residential Whole Home Generator Load Reduction Results

Table 34 summarizes the residential whole home generator segment load reduction results for each event. Using the adjusted baseline approach, the average reduction per home for the residential whole home generator population is 2.37 kW. The residential whole home generator AMI data is collected is per home. No per device adjustment is needed as each home only has one device. An offline adjustment factor is not required since the load associated with a non-curtailed device is included in the whole-home AMI data.

Table 34: Residential Whole Home Generator Summary of 2019 Events

TempF	Date	StartTime	EndTime	kW	Qualifying Day
92	07/19/2019	15:00	19:00	2.85	No
93	07/30/2019	15:00	17:00	2.37	Yes
87	08/08/2019	15:00	19:00	1.53	No
88	08/19/2019	17:00	19:00	2.13	No
				2.37	Average Qualifying

12.2.5 Small Commercial A/C Thermostat Load Reduction Results

Table 35 summarizes the small commercial thermostat segment load reduction results for each event. Using the adjusted baseline approach, the average reduction per device for the small commercial A/C thermostat population is 1.48 kW. The numbers presented below includes an 84.8%, 84.8%, 86.5%, and 86.5% adjustment for 7/19, 7/30, 8/8, and 8/19 respectively, to account for offline devices that were not curtailed.

Table 35: Small Commercial Thermostat Summary of 2019 Events

TempF	Date	StartTime	EndTime	kW	Qualifying Day
92	07/19/2019	15:00	19:15	1.19	No
93	07/30/2019	15:00	17:15	1.48	Yes
87	08/08/2019	15:00	19:15	1.13	No
88	08/19/2019	17:00	19:15	0.97	No
				1.48	Average Qualifying

12.3 C&I Event Day Details

For the 2019 curtailment season, each customer participated in one test event and four customers participated in retest events. A retest was performed for four of the participants due to under-performance in first test event. The event details are presented in *Table 36*.

Table 36: C&I Event Dates Summary

Date	Start Time	End Time	Notes
07/19/2019	16:00	17:00	Large Commercial & Industrial Test Event for 9 Customers
08/22/2019	16:00	17:00	Large Commercial & Industrial Test Event for 1 Customer
09/04/2019	15:00	16:00	Large Commercial & Industrial Retest Event for 3 Customers
09/27/2019	16:00	17:00	Large C&I Test Event for 1 Customer & Retest for 1 Customer

Table 37 summarizes the C&I population load reduction results for each event hour. The total reduction for the C&I population is 7.84 MW.

Table 37: C&I Summary of 2019 Events

Date	Start Time	End Time	Zone	CBL (kW)	Event Hour Usage (kW)	Load Reduction (kW)
07/19/2019	16:00	17:00	NW Corridor	801	570	231
07/19/2019	16:00	17:00	Merritt Park	923	259	664
08/22/2019	16:00	17:00	NW Corridor	2128	34	2094
09/04/2019	15:00	16:00	NW Corridor	907	30	877
09/04/2019	15:00	16:00	Fishkill	86	5	80
09/27/2019	16:00	17:00	NW Corridor	3905	12	3892

12.4 Final kW Calculation

The residential segment load reduction estimates in 2019 are based on those event hours where the temperature was at or above 93°F and therefore represent a scenario of load constraint. The thermostat and pool pump load reduction estimates are obtained from those sites that reported telemetries data on all the days used in the load reduction calculation. Similarly, the AMI load reduction estimates are obtained from those sites that had valid AMI data on all the days used in the load reduction calculation. The reduction for each 15-minute interval, during the event hour, is estimated by taking the difference between the average adjusted baseline and the average event day load. The first 15-minute interval for each event is excluded as this time interval is when the population is ramping into curtailment.

For the 2019 curtailment season, there was a total of one qualifying curtailment event used to calculate the kW factors for the residential and small commercial populations. In addition, there was one test event for each

of the large commercial & industrial (C&I) participant population, with four C&I customers participating in a retest event.

Tables 38 through *40* present the total MW savings for the 2019 control season by region. As shown in the tables below, the demand response reduction for the Fishkill, Merritt Park, and Northwest Corridor regions are 2.638, 0.957, and 8.402 MW, respectively. These savings numbers are based on the total number of end points installed in Central Hudson Peak Perks program as of September 30th, 2019.

Table 38: Summary of Reduction: Fishkill/Shenandoah

Population	Device	Active end points as of 10/01/19	kW Factor (Hourly Avg)	Total MW Savings
Residential	Thermostat - A/C	776	1.229	0.954
Residential	DCU - A/C	1474	0.932	1.374
Residential	DCU - Pool Pump	33	0.506	0.017
Residential	DCU - Generator	17	2.371	0.040
Small Commercial	Thermostat - A/C	67	1.476	0.099
Small Commercial	DCU - A/C	78	0.947	0.074
Large C&I	Curtailment			0.080
Total				2.638

Table 39: Summary of Reduction: Merritt Park

Population	Device	Active end points as of 10/01/19	kW Factor (Hourly Avg)	Total MW Savings
Residential	Thermostat - A/C	67	1.229	0.082
Residential	DCU - A/C	198	0.932	0.185
Residential	DCU - Pool Pump	0	0.506	0.000
Residential	DCU - Generator	8	2.371	0.019
Small Commercial	Thermostat - A/C	5	1.476	0.007
Small Commercial	DCU - A/C	0	0.947	0.000
Large C&I	Curtailment			0.664
Total				0.957

Table 40: Summary of Reduction: NW Corridor

Population	Device	Active end points as of 10/01/19	kW Factor (Hourly Avg)	Total MW Savings
Residential	Thermostat - A/C	146	1.229	0.179
Residential	DCU - A/C	1085	0.932	1.011
Residential	DCU - Pool Pump	30	0.506	0.015
Residential	DCU - Generator	17	2.371	0.040
Small Commercial	Thermostat - A/C	25	1.476	0.037
Small Commercial	DCU - A/C	27	0.947	0.026
Large C&I	Curtailment			7.094
Total				8.402

Table 41, below, presents the total MW reduction for the 2019 control season by segment. The demand response reduction for the residential and small commercial populations is 4.159 MW, based on a total of 4,053 end points installed in Central Hudson Peaks Perks program service area as of September 30th, 2019. The demand response reduction for the C&I population is 7.838 MW based on the curtailment performance of eleven customers. The demand response reduction for the entire Peak Perks program is 11.997 MW.

Table 41: Summary of Reduction: All Zones

Population	Device	Active end points as of 10/01/19	kW Factor (Hourly Avg)	Total MW Savings
Residential	Thermostat - A/C	989	1.229	1.215
Residential	DCU - A/C	2757	0.932	2.570
Residential	DCU - Pool Pump	63	0.506	0.032
Residential	DCU - Generator	42	2.371	0.100
Small Commercial	Thermostat - A/C	97	1.476	0.143
Small Commercial	DCU - A/C	105	0.947	0.099
Large C&I	Curtailment			7.838
Total				11.997

13 Participant Impact

13.1 Opt-Outs

As the season progresses, the number of opt-outs are monitored (either a program opt-out or an opt-out for the day). An opt-out is defined as when the customer no longer wants to participate in the program. *Figure 40* shows the cumulative opt-out rate as a percentage of the number of active customers as of September 30, 2019.

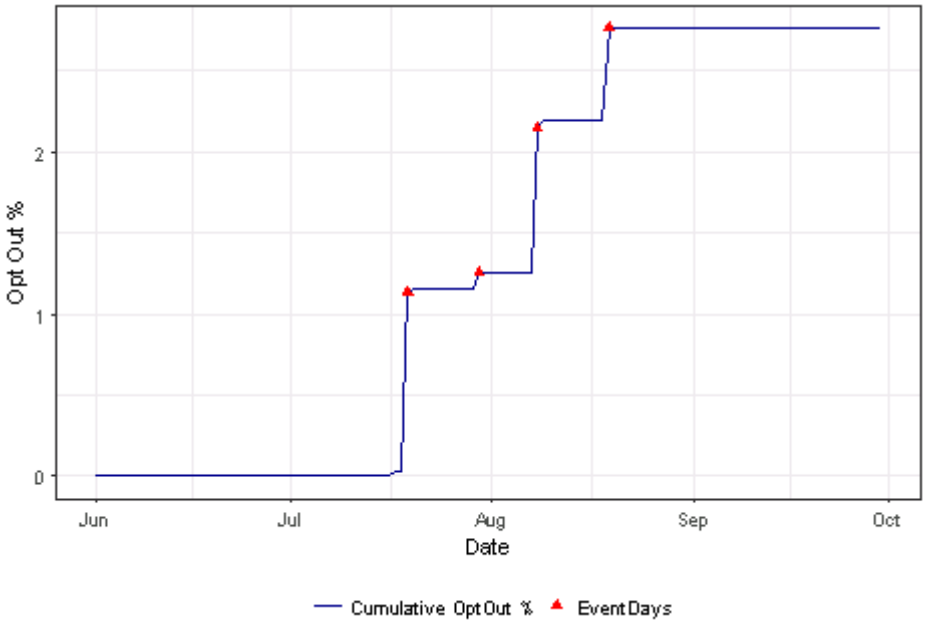

Figure 40: Cumulative Opt-Out as a Percent of Population

14 Comparison with Prior Years' Results

Table 42 presents a summary of results for the program for 2019 and 2018.

Table 42: kW Factor History

Population Segment	2019	2018
Residential - Thermostat A/C (kW)	1.229	1.295
Residential - DCU A/C (kW)	0.932	0.949
Residential - DCU Pool Pump (kW)	0.506	0.57
Residential - Generator (kW)	2.371	3.896
Small Commercial - Thermostat A/C (kW)	1.476	2.215
Small Commercial - DCU A/C (kW)	0.947	1.25
Average Total Estimated Load Reduction (MW)	4.159	4.378

Notes: All kW factors are the average reduction over all event hours, excluding the first 15-minutes of the event.
An adjustment factor is applied to thermostats and pool pumps to account for offline devices based on the actual offline devices at the time of the event.
An A/Cs per home ratio is applied to the residential A/C DCU data to calculate a per device kW factor from the Insights+ whole home data.

14.1 Load Reduction kW Factor for 2018

Table 43 summarizes the load reduction results for 2018. For the 2018 curtailment season there were three qualifying curtailment events used to calculate these load reduction results. The calculated reduction for the residential A/C thermostat population is 1.30 kW. The calculated reduction for the residential A/C DCU population is 0.95 kW. The calculated reduction for the residential pool pump population is 0.57 kW. The calculated reduction for the residential whole home generator population is 3.90 kW. The calculated reduction for the small commercial thermostat population is 2.22 kW. The estimated reduction for the small commercial DCU population is based on the relationship of residential thermostat to DCU savings per ton (i.e. SmallCommTstat/Ton * [(ResDCU/Ton)/(ResTstat/Ton)]*SmallCommDCU_AveTon). This resulted in a 4.38 MW demand response reduction estimate when applying the kW factor estimate to the active number of end points at the end of the season for each population.

Table 43: 2018 kW Reduction Results

Population Segment	kW Factor
Residential - Thermostat A/C (kW)	1.295
Residential - DCU A/C (kW)	0.949
Residential - DCU Pool Pump (kW)	0.57
Residential - Generator (kW)	3.896
Small Commercial - Thermostat A/C (kW)	2.215
Small Commercial - DCU A/C (kW)	1.25
Average Total Estimated Load Reduction (MW)	4.378

Notes: All the kW factors are the average reduction over all event hours, excluding the first 15-minutes of the event.
An adjustment factor is applied to thermostats and pool pumps to account for offline devices based on the actual offline devices at the time of the event.
An A/Cs per home ratio is applied to the residential A/C DCU data to calculate a per device kW factor from the Insights+ whole home data.

14.2 Load Reduction kW Factor for 2019

Table 44 summarizes the load reduction results for 2019. For the 2019 curtailment season there were one qualifying curtailment events used to calculate these load reduction results. The calculated reduction for the residential A/C thermostat population is 1.23 kW. The calculated reduction for the residential A/C DCU population is 0.93 kW. The calculated reduction for the residential pool pump population is 0.51 kW. The calculated reduction for the residential whole home generator population is 2.37 kW. The calculated reduction for the small commercial thermostat population is 1.48 kW. The estimated reduction for the small commercial DCU population is based on the relationship of residential thermostat to DCU savings per ton (i.e. SmallCommTstat/Ton * [(ResDCU/Ton)/(ResTstat/Ton)]*SmallCommDCU_AveTon). This resulted in a 4.16 MW demand response reduction estimate when applying the kW factor estimate to the active number of end points at the end of the season for each population.

Table 44: 2019 kW Reduction Results

Population Segment	2019
Residential - Thermostat A/C (kW)	1.229
Residential - DCU A/C (kW)	0.932
Residential - DCU Pool Pump (kW)	0.506
Residential - Generator (kW)	2.371
Small Commercial - Thermostat A/C (kW)	1.476
Small Commercial - DCU A/C (kW)	0.947
Average Total Estimated Load Reduction (MW)	4.159

Notes: All the kW factors are the average reduction over all event hours, excluding the first 15-minutes of the event.
An adjustment factor is applied to thermostats and pool pumps to account for offline devices based on the actual offline devices at the time of the event.
An A/Cs per home ratio is applied to the residential A/C DCU data to calculate a per device kW factor from the Insights+ whole home data.

15 Load Available for Curtailment

15.1 Temperature vs. Load Regression

Analysis of the temperature and the load data from the M&V sites indicates a strong positive correlation between these two variables. The available load can be estimated by regression analysis. *Figure 41* shows the hourly average load versus the temperature for the residential thermostat population. The hourly average load is calculated for non-holiday, non-event weekdays between June 1, 2019 and September 30, 2019 for the hours between 2-8PM EDT. The hourly temperature is from the NOAA KPOU weather station in Poughkeepsie, NY. The regression analysis indicates that there is approximately a 0.066 kW increase in load for every one-degree F increase in temperature based on data at or above 70°F. Based on these models, a temperature of 95°F would yield a load of about 2 kW on average.

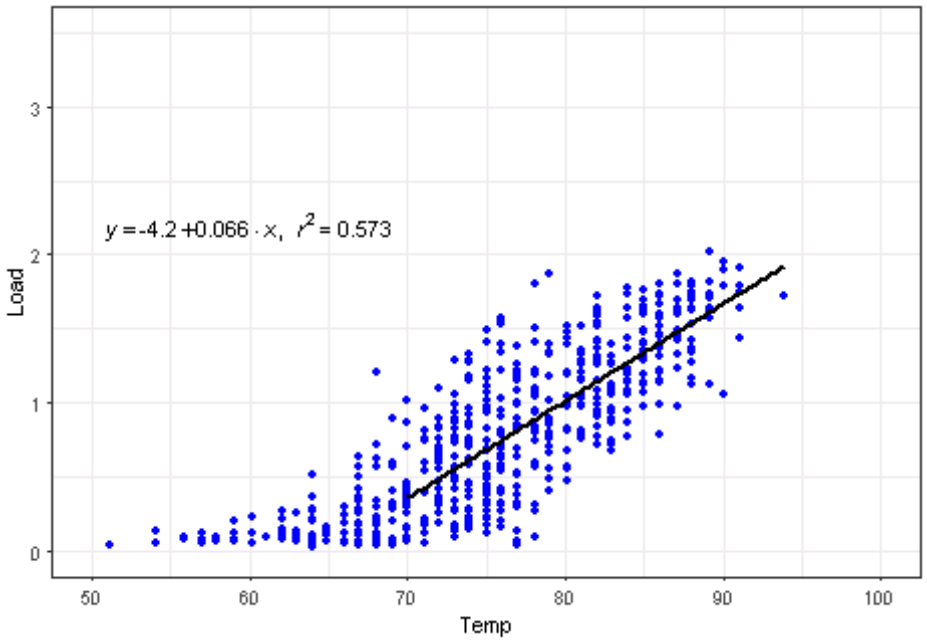

Figure 41: Residential Thermostat Temperature vs. A/C Load

Figure 42 shows the hourly average load versus the temperature for the residential DCU population. The regression analysis indicates that there is approximately a 0.07 kW increase in load for every one-degree F increase in temperature. Based on these models, a temperature of 95°F would yield a load of about 2.9 kW on average. The data shown in the figure below illustrates the average whole home load. This load can contain multiple A/Cs (with multiple curtailment devices) as well as all other load in the home, and when a participant has solar it can contain negative load if the customer is pushing electricity back to the grid. The graph below does not present the total A/C load available for curtailment, it presents the total home load (of which the A/C load(s) is/are some portion).

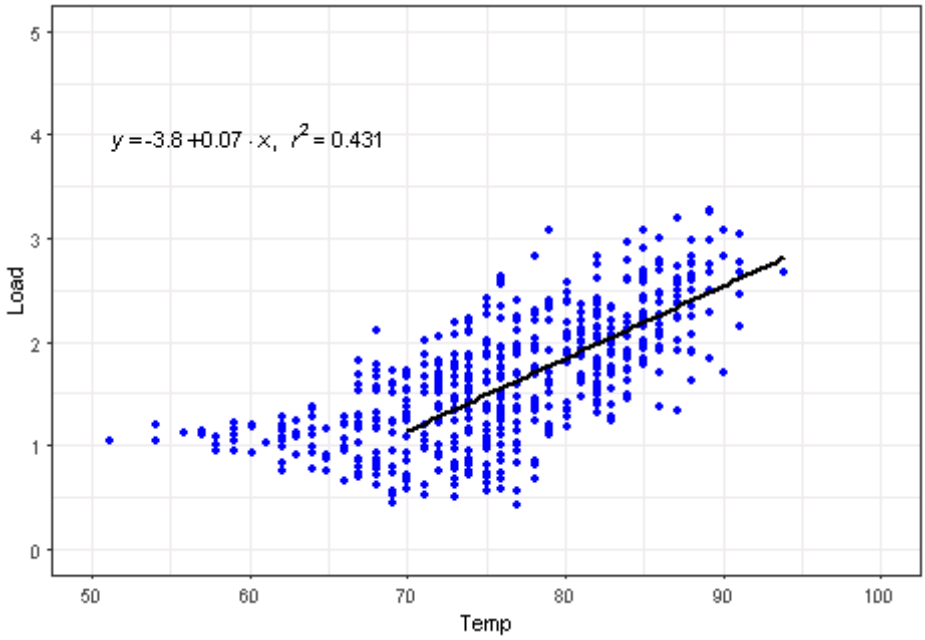

Figure 42: Residential DCU Temperature vs. Whole Home Load

Figure 43 shows the hourly average load versus the temperature for the small commercial thermostat population. The regression analysis indicates that there is approximately a 0.094 kW increase in load for every one-degree F increase in temperature. Based on these models, a temperature of 95°F would yield load of about 3.4 kW of average load.

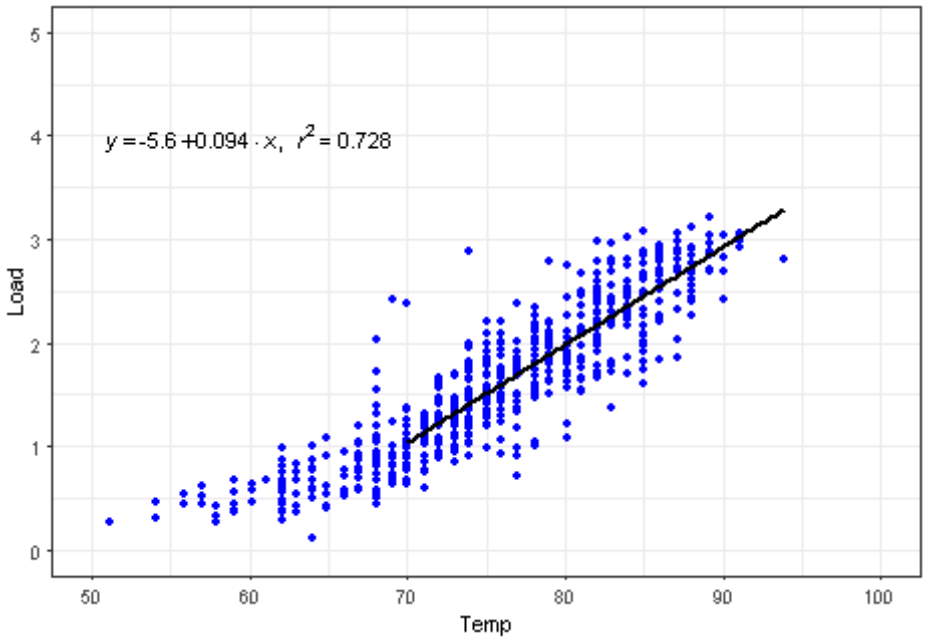

Figure 43: Small Commercial Temperature vs. A/C Load

15.2 Estimate of Residential Thermostat Demand Response

Using the regression model from *Section 15* for the residential thermostat population, the available load for curtailment is estimated using different curtailment strategy percentages and a reception percentage of 90%. *Figure 44* shows the modeled available load from the regression model and the estimated load reduction using 25%, 50%, and 75% ADI curtailment methodologies. The estimated load reduction is calculated as:

$$Estimated\ Load\ Reduction\ (kW) = (Available\ Load\ (kW))(Curtailment\%)(Reception\%)$$

For a temperature of 95°F, the 50% ADI load reduction is estimated as 0.84 kW. Note that in the 2019 control season most higher temperature days were either on weekends, holidays, or during curtailment events and are therefore not included in this regression analysis.

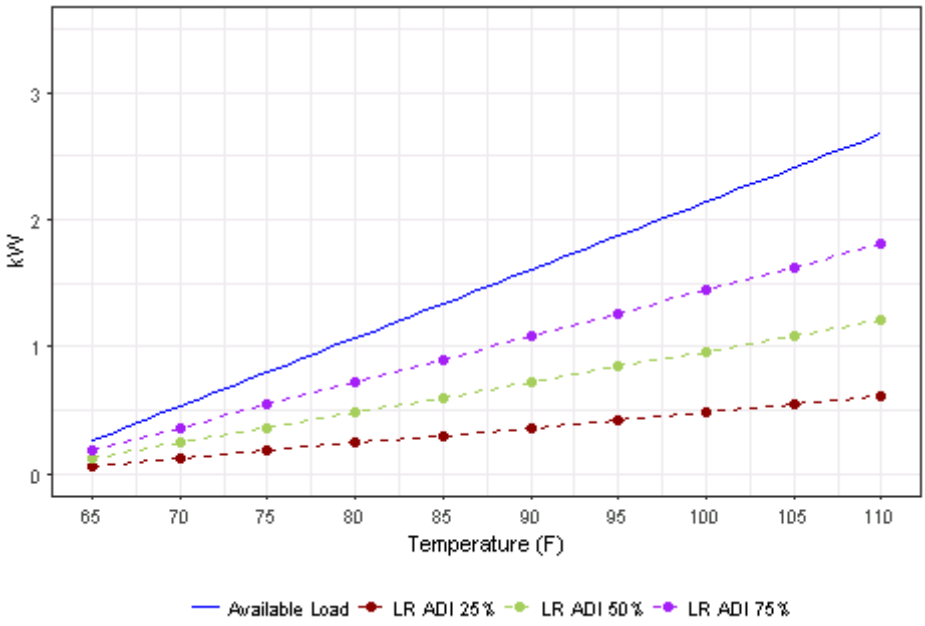

Figure 44: Residential Estimated Load Reduction

Table 45 presents the load reduction estimate for the residential thermostat population for select temperatures.

Table 45: Residential Thermostat Estimated Load Reduction

Cycling Level	85	87	89	91	93	95	97
ADI 25%	0.30	0.33	0.36	0.39	0.42	0.45	0.48
ADI 50%	0.60	0.66	0.72	0.78	0.84	0.90	0.96
ADI 75%	0.91	0.99	1.08	1.17	1.26	1.35	1.44
100% Shed	1.21	1.33	1.44	1.56	1.68	1.80	1.92

16 Conclusions

For the 2019 curtailment season, Central Hudson called a total of four curtailment events for the residential and small commercial populations and one test event for each of the large commercial & industrial (C&I) participant population, with four C&I customers participating in a retest event.

Table 46, below, presents the total MW reduction for the 2019 control season by segment. The demand response reduction for the residential and small commercial populations is 4.159 MW, based on the total installed end points of 4,053 throughout Central Hudson Peaks Perks program service area as of September 30th, 2019. The demand response reduction for the C&I population is 7.838 MW based on the curtailment performance of eleven customers. The demand response reduction for the entire Peak Perks program is 11.997 MW.

Table 46: Summary of Reduction

Population	Device	Active end points as of 10/01/19	kW Factor (Hourly Avg)	Total MW Savings
Residential	Thermostat - A/C	989	1.229	1.215
Residential	DCU - A/C	2,757	0.932	2.570
Residential	DCU - Pool Pump	63	0.506	0.032
Residential	DCU - Generator	42	2.371	0.100
Small Commercial	Thermostat - A/C	97	1.476	0.143
Small Commercial	DCU - A/C	105	0.947	0.099
Large C&I	Curtailment	11		7.838
Total		4,064		11.997

Note: Small Commercial DCU devices were not evaluated. The kW factor for this segment is estimated based on the relationship of residential thermostat to DCU savings per ton.

Sign Off Sheet

Pursuant to the contract between Central Hudson Gas & Electric Corporation and Itron Inc. for the Peak Perks Load Control Program ("Contract"), the undersigned hereby acknowledge and accept the M&V impact results for the Peak Perks program to be 1.23 kW for the residential A/C thermostat population, 0.93 kW for the residential A/C DCU population, 0.51 kW for the residential pool pump DCU population, 2.37 kW for the residential whole home generator population, 1.48 kW for the small commercial A/C thermostat population, and 0.95 kW for the small commercial A/C DCU population. The undersigned further acknowledge and agree that these calculations were made according to the methodologies and procedures prescribed in the Contract and accept the results to be valid for the Contract year ended September 30, 2019.

Signature: _____

Name: Jean Shelton, Ph.D.

Title: Director, Strategic Analytics

Company: Itron, Inc.

Signature: _____

Name: Cory Scofield

Title: Program Manager

Company: Central Hudson Gas & Electric Corporation

Glossary

Term	Definition
A/C	Air Conditioner
AA	The Adaptive Algorithm is an Itron innovation, which insures that significant load reduction is contributed by each load management switch in the system even if the A/C system is running considerably under its maximum capacity before and during the curtailment period. The objective of the algorithm is to obtain a similar run time percentage reduction from A/C systems running at capacity as well as from those running at a rate somewhat less than full capacity. However, if an A/C system runtime is measured at less than 10% of the time, the algorithm assumes that the unit is off and a default reduction is implemented. The DCU is continually recording the run time of the A/C compressor for the previous hour. Assuming the measured run time of Y% and > 10%, when an AA curtailment message is received by the DCU for X% then the A/C is allowed to run (100%-X%)*Y% for a 30 minute interval. If Y% is < 10% then the A/C is allowed to run at 100%-X% for a 30-minute interval, the default reduction.
ADI	Adaptive Distributed Intelligence (ADI) is a method of performing Direct Load Control (DLC) with a randomized start time based on the actual usage of the attached appliance.
ArcGIS	A geographic information system (GIS) developed by ESRI of Redlands, CA. A GIS database integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information.
BYOT	Bring Your Own Thermostat
CBL	Customer Baseline
CL	Connected Load. The Connected Load is set to the 99th percentile operating A/C load over the entire summer for those intervals that were greater than 700 Watts. If the nominal capacity of the A/C is known and the 99th percentile is 1.5 times greater than that value, then the 95th percentile was used to remove unreasonably high loads.
DENT	DENT Data Loggers are end-use metering devices. They are portable and can be used on a single or three phase system using a 80-600V phase-to-phase (AC or DC) services when line powered or 0-600V (AC or DC) when externally powered. The Meter Communication Module measures energy parameters (instantaneous voltage, current, power and power factor, and accumulated energy usage). The DENT ELOG program retrieves and stores the data.
DI	Distributed Intelligence (DI) is a method of performing Direct Load Control (DLC) with a randomized start time to provide a smooth load shed ramp over the population.
DR	Demand Response

Continued on next page

Term	Definition
EDX SignalPro	EDX® SignalPro® is the principal building block of EDX s comprehensive line of wireless network engineering tools. It offers all of the study types needed to design a basic wireless network, including area studies, link/point-to-point studies and route studies. EDX SignalPro also incorporates the telecom-specific mapping features, equipment data storage capabilities and convenient utility functions. Basic EDX SignalPro can be extended to become a fully featured and comprehensive network design tool by attaching the EDX network design and indoor modules, specialized query toolkits and data management products.
FSR	Field Service Request.
IntelliPEAK Switch	Highly reliable load control switch designed for electric utilities running demand response programs. Combining multiple relay outputs and a robust set of control strategies, a single devices can control multiple appliances, including HVAC units, electric water heaters, or pumps.
IntelliSOURCE	The Itron IntelliSOURCE platform is an enterprise-class software server and operating environment for energy management. IntelliSOURCE provides a two-way communication link to residential and commercial and industrial customers and supports direct load, dynamic pricing controls, and next generation upgrades such as variable pricing, renewable energy management, and electric vehicle charging. Key features include: Communications to existing back office infrastructure and support for third-party systems. Command and control: Handles grouping and addressing structures; algorithms and curtailment operations; device management and configuration; and event generation and control. Data management. Analysis and evaluation of the performance of DR programs.
IntelliTEMP DirectLink	Smart thermostat which combines a streamlined design with a modular Wi-Fi radio that eliminates the need for third-party products to deliver two-way communications between a utility and end user. The use of IP-based communications provides near real-time feedback, near real-time presence, and constant telemetry of IntelliTEMP DirectLink devices to give utilities a clearer view of currently available load.
kW	Kilowatt: One Kilowatt equals 1000W.
M&V	Measurement and Verification.
MW	Megawatt: One Megawatt equals 1000 kW
NAESB	North American Energy Standards Board
NOAA	National Oceanic and Atmospheric Administration
NYISO	New York Independent System Operator

Continued on next page

Term	Definition
OTA	Over-the-air (OTA) messaging provides remote control of curtailment devices for service and subscription activation, personalization and programming of a new service and device features.
PCT	Programmable Control Thermostat.
PowerCAMP	PowerCAMP was developed by Itron to allow for data collection from M&V sites.
QA/QC	Quality Assurance/Quality Control
R	A programming language and software environment for statistical computing and graphics.
R2	R2 is the square of correlation coefficient (measure of the strength of linear dependence between two variables) between the observations (outcomes) and their predicted values and is described by the following formula: R2 = {Sum of Squares of Residuals (sum or squared errors of predictions}/{Sum of Squares of the difference of the dependent variable and its mean (variance)}
RDLC	Repeating Direct Load Control is a method of Direct Load Control (DLC) whereby all devices start curtailment at the same time and have a +/- 1.5 minute randomized ramp out of curtailment.
RTM	The Remote Terminal Monitor (RTM) receives all of the pages transmitted and forwards this information back to PowerCAMP/IntelliSOURCE. A comparison is made to verify that each message transmitted is received in the project area. The system is programmed to listen for messages with the specific CAPCODE assigned to the project. If an expected message is not received then program operators are alerted by the system.
SOC	The Itron Solution Operations Center (SOC) monitors the servers (PowerCAMP and IntelliSOURCE) to ensure the applications required to collect the data are running and monitors the curtailment events.
THI	Temperature Heat Index
Tonnage, A/C Ton	A measure of curtailment capacity of an A/C. One Ton equals 12000 BTUs/hr

A Event Day Reduction Tables

For the 2019 curtailment season for the residential and small commercial populations, there were four curtailment events. This Appendix details the 15-minute reductions using the baseline adjustment method. The graphs for these events are presented in *Section 12*.

A.1 Residential A/C Thermostat

Table 48: Residential Thermostat 15-minute Load Reductions July 19, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	92	0.77	1.44	1.75	0.98
15:15	92	0.63	1.46	1.78	1.15
15:30	92	0.65	1.47	1.79	1.14
15:45	92	0.62	1.49	1.81	1.19
16:00	92	0.66	1.53	1.85	1.19
16:15	92	0.63	1.53	1.86	1.22
16:30	92	0.68	1.54	1.87	1.19
16:45	92	0.66	1.54	1.87	1.21
17:00	92	0.70	1.56	1.90	1.20
17:15	92	0.67	1.56	1.90	1.23
17:30	92	0.70	1.57	1.91	1.21
17:45	92	0.68	1.56	1.89	1.21
18:00	91	0.72	1.59	1.93	1.20
18:15	91	0.70	1.59	1.93	1.22
18:30	91	0.73	1.57	1.91	1.18
18:45	91	0.71	1.55	1.88	1.17

Table 49: Residential Thermostat 15-minute Load Reductions July 30, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	93	0.75	1.42	1.80	1.05
15:15	93	0.71	1.48	1.88	1.17
15:30	93	0.63	1.50	1.91	1.28
15:45	93	0.67	1.49	1.89	1.22
16:00	94	0.65	1.52	1.92	1.27
16:15	94	0.69	1.53	1.94	1.25
16:30	94	0.66	1.54	1.95	1.29
16:45	94	0.70	1.54	1.96	1.26

Table 50: Residential Thermostat 15-minute Load Reductions August 8, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	87	0.50	1.19	1.21	0.71
15:15	87	0.43	1.22	1.23	0.81
15:30	87	0.46	1.27	1.28	0.82
15:45	87	0.45	1.30	1.31	0.86
16:00	86	0.47	1.32	1.34	0.87
16:15	86	0.46	1.33	1.35	0.89
16:30	86	0.47	1.37	1.39	0.92
16:45	86	0.48	1.38	1.39	0.91
17:00	85	0.48	1.39	1.40	0.92
17:15	85	0.51	1.40	1.42	0.91
17:30	85	0.49	1.41	1.42	0.93
17:45	85	0.51	1.40	1.42	0.91
18:00	73	0.53	1.43	1.45	0.91
18:15	73	0.53	1.41	1.42	0.89
18:30	73	0.53	1.38	1.39	0.86
18:45	73	0.50	1.35	1.37	0.87

Table 51: Residential Thermostat 15-minute Load Reductions August 19, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
17:00	88	0.73	1.16	1.64	0.92
17:15	88	0.62	1.18	1.68	1.06
17:30	88	0.60	1.18	1.67	1.07
17:45	88	0.62	1.16	1.65	1.04
18:00	86	0.59	1.17	1.66	1.06
18:15	86	0.64	1.17	1.66	1.01
18:30	86	0.60	1.13	1.60	1.00
18:45	86	0.63	1.11	1.58	0.94

A.2 Residential A/C DCU

Table 52: Residential DCU 15-minute Load Reductions July 19, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	92	1.68	2.01	2.53	0.85
15:15	92	1.75	2.04	2.57	0.82
15:30	92	1.81	2.07	2.60	0.79
15:45	92	1.83	2.13	2.67	0.84
16:00	92	1.78	2.16	2.71	0.93
16:15	92	1.78	2.23	2.80	1.02
16:30	92	1.86	2.24	2.82	0.96
16:45	92	1.95	2.25	2.83	0.88
17:00	92	2.04	2.31	2.91	0.87
17:15	92	2.00	2.42	3.04	1.04
17:30	92	2.06	2.38	2.99	0.93
17:45	92	2.06	2.37	2.98	0.92
18:00	91	2.11	2.36	2.97	0.86
18:15	91	2.02	2.30	2.89	0.87
18:30	91	2.06	2.28	2.86	0.80
18:45	91	1.97	2.22	2.79	0.82

Table 53: Residential DCU 15-minute Load Reductions July 30, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	93	1.69	1.97	2.49	0.80
15:15	93	1.55	2.04	2.57	1.02
15:30	93	1.74	2.06	2.61	0.86
15:45	93	1.67	2.12	2.67	1.01
16:00	94	1.84	2.14	2.71	0.86
16:15	94	1.72	2.20	2.78	1.05
16:30	94	1.95	2.23	2.82	0.87
16:45	94	1.76	2.23	2.82	1.06

Table 54: Residential DCU 15-minute Load Reductions August 8, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	87	1.11	1.81	1.66	0.55
15:15	87	1.21	1.83	1.68	0.47
15:30	87	1.13	1.87	1.72	0.60
15:45	87	1.36	1.93	1.77	0.42
16:00	86	1.24	1.95	1.79	0.55
16:15	86	1.50	1.99	1.82	0.33
16:30	86	1.37	2.07	1.90	0.53
16:45	86	1.64	2.07	1.90	0.25
17:00	85	1.52	2.05	1.89	0.36
17:15	85	1.71	2.08	1.91	0.20
17:30	85	1.53	2.06	1.89	0.37
17:45	85	1.80	2.05	1.88	0.08
18:00	73	1.59	2.02	1.86	0.27
18:15	73	1.82	2.00	1.84	0.02
18:30	73	1.56	1.95	1.79	0.24
18:45	73	1.66	1.93	1.77	0.11

Table 55: Residential DCU 15-minute Load Reductions August 19, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
17:00	88	1.61	1.82	2.34	0.73
17:15	88	1.77	1.88	2.41	0.65
17:30	88	1.77	1.81	2.33	0.56
17:45	88	1.87	1.77	2.28	0.41
18:00	86	1.74	1.84	2.37	0.63
18:15	86	1.77	1.81	2.33	0.56
18:30	86	1.78	1.82	2.34	0.56
18:45	86	1.78	1.78	2.29	0.51

A.3 Residential Pool Pump

Table 56: Residential Pool Pump 15-minute Load Reductions July 19, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	92	0.00	0.58	0.57	0.57
15:15	92	0.00	0.55	0.54	0.54
15:30	92	0.00	0.55	0.54	0.54
15:45	92	0.00	0.55	0.54	0.54
16:00	92	0.00	0.55	0.54	0.54
16:15	92	0.00	0.52	0.52	0.52
16:30	92	0.00	0.50	0.50	0.50
16:45	92	0.00	0.48	0.47	0.47
17:00	92	0.00	0.47	0.46	0.46
17:15	92	0.00	0.47	0.46	0.46
17:30	92	0.00	0.47	0.46	0.46
17:45	92	0.00	0.47	0.46	0.46
18:00	91	0.00	0.46	0.45	0.45
18:15	91	0.00	0.41	0.40	0.40
18:30	91	0.00	0.38	0.38	0.38
18:45	91	0.00	0.38	0.38	0.38

Table 57: Residential Pool Pump 15-minute Load Reductions July 30, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	93	0	0.57	0.56	0.56
15:15	93	0	0.56	0.55	0.55
15:30	93	0	0.56	0.54	0.54
15:45	93	0	0.54	0.53	0.53
16:00	94	0	0.52	0.50	0.50
16:15	94	0	0.49	0.47	0.47
16:30	94	0	0.49	0.48	0.48
16:45	94	0	0.47	0.46	0.46

Table 58: Residential Pool Pump 15-minute Load Reductions August 8, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	87	0.00	0.57	0.56	0.56
15:15	87	0.00	0.58	0.56	0.56
15:30	87	0.00	0.58	0.56	0.56
15:45	87	0.00	0.56	0.54	0.54
16:00	86	0.00	0.52	0.50	0.50
16:15	86	0.00	0.49	0.47	0.47
16:30	86	0.00	0.49	0.48	0.48
16:45	86	0.00	0.48	0.47	0.47
17:00	85	0.00	0.48	0.47	0.47
17:15	85	0.00	0.48	0.47	0.47
17:30	85	0.00	0.49	0.48	0.48
17:45	85	0.00	0.49	0.48	0.47
18:00	73	0.00	0.47	0.46	0.46
18:15	73	0.00	0.44	0.42	0.42
18:30	73	0.00	0.42	0.40	0.40
18:45	73	0.00	0.41	0.39	0.39

Table 59: Residential Pool Pump 15-minute Load Reductions August 19, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
17:00	88	0	0.44	0.41	0.41
17:15	88	0	0.43	0.41	0.41
17:30	88	0	0.43	0.41	0.41
17:45	88	0	0.43	0.41	0.41
18:00	86	0	0.43	0.41	0.41
18:15	86	0	0.40	0.38	0.38
18:30	86	0	0.37	0.36	0.36
18:45	86	0	0.37	0.36	0.36

A.4 Residential Whole Home Generator

Table 60: Residential Whole Home Generator 15-minute Load Reductions July 19, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	92	0.52	3.09	3.53	3.01
15:15	92	0.70	3.06	3.49	2.79
15:30	92	0.65	3.16	3.61	2.96
15:45	92	0.66	3.12	3.57	2.91
16:00	92	0.93	3.26	3.72	2.79
16:15	92	0.91	3.34	3.82	2.90
16:30	92	1.06	3.41	3.89	2.83
16:45	92	0.74	3.39	3.88	3.14
17:00	92	0.91	3.37	3.85	2.94
17:15	92	1.16	3.30	3.77	2.62
17:30	92	1.35	3.47	3.96	2.61
17:45	92	1.26	3.51	4.01	2.75
18:00	91	1.34	3.64	4.16	2.82
18:15	91	1.16	3.58	4.09	2.94
18:30	91	1.11	3.45	3.94	2.83
18:45	91	1.16	3.42	3.91	2.75

Table 61: Residential Whole Home Generator 15-minute Load Reductions July 30, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	93	1.80	2.90	3.70	1.90
15:15	93	1.24	2.92	3.73	2.49
15:30	93	1.63	3.06	3.91	2.28
15:45	93	1.27	3.06	3.91	2.65
16:00	94	1.55	3.09	3.95	2.40
16:15	94	1.62	3.10	3.96	2.34
16:30	94	1.75	3.20	4.09	2.34
16:45	94	1.54	3.23	4.12	2.58

Table 62: Residential Whole Home Generator 15-minute Load Reductions August 8, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	87	0.44	2.26	2.35	1.91
15:15	87	0.81	2.26	2.34	1.53
15:30	87	0.58	2.35	2.44	1.86
15:45	87	0.89	2.41	2.50	1.61
16:00	86	0.80	2.37	2.46	1.66
16:15	86	1.17	2.12	2.20	1.04
16:30	86	1.07	2.20	2.28	1.20
16:45	86	1.09	2.24	2.32	1.23
17:00	85	1.05	2.24	2.33	1.28
17:15	85	1.29	2.34	2.43	1.14
17:30	85	1.16	2.31	2.39	1.23
17:45	85	0.86	2.48	2.57	1.71
18:00	73	0.61	2.52	2.61	2.00
18:15	73	0.87	2.51	2.61	1.74
18:30	73	0.80	2.51	2.61	1.80
18:45	73	1.04	2.44	2.53	1.49

Table 63: Residential Whole Home Generator 15-minute Load Reductions August 19, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
17:00	88	0.90	2.33	3.52	2.62
17:15	88	1.21	2.38	3.59	2.38
17:30	88	1.27	2.31	3.48	2.21
17:45	88	1.63	2.36	3.55	1.92
18:00	86	1.46	2.30	3.47	2.01
18:15	86	1.53	2.33	3.51	1.98
18:30	86	1.37	2.29	3.45	2.08
18:45	86	1.55	2.22	3.35	1.80

A.5 Small Commercial A/C Thermostats

Table 64: Small Commercial Thermostat 15-minute Load Reductions July 19, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	92	1.28	2.51	2.63	1.35
15:15	92	1.18	2.42	2.54	1.36
15:30	92	1.03	2.48	2.60	1.57
15:45	92	1.15	2.64	2.77	1.61
16:00	92	0.98	2.52	2.64	1.66
16:15	92	1.17	2.41	2.52	1.36
16:30	92	0.97	2.35	2.47	1.50
16:45	92	1.18	2.36	2.48	1.29
17:00	92	1.00	2.29	2.40	1.40
17:15	92	1.21	2.09	2.19	0.99
17:30	92	0.91	2.12	2.22	1.32
17:45	92	1.12	1.98	2.08	0.96
18:00	91	0.96	1.83	1.92	0.96
18:15	91	1.03	1.82	1.90	0.88
18:30	91	0.93	1.70	1.78	0.85
18:45	91	1.22	1.67	1.75	0.53

Table 65: Small Commercial Thermostat 15-minute Load Reductions July 30, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	93	1.50	2.36	2.49	0.99
15:15	93	1.14	2.39	2.52	1.38
15:30	93	1.03	2.40	2.53	1.50
15:45	93	1.02	2.54	2.69	1.66
16:00	94	1.00	2.54	2.69	1.68
16:15	94	1.06	2.44	2.57	1.51
16:30	94	0.98	2.41	2.55	1.57
16:45	94	1.04	2.37	2.50	1.46

Table 66: Small Commercial Thermostat 15-minute Load Reductions August 8, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
15:00	87	1.37	2.19	2.37	1.00
15:15	87	0.92	2.20	2.38	1.46
15:30	87	1.21	2.25	2.44	1.23
15:45	87	0.87	2.19	2.38	1.50
16:00	86	1.01	2.17	2.35	1.34
16:15	86	0.92	2.21	2.39	1.47
16:30	86	0.98	2.16	2.34	1.37
16:45	86	0.88	2.17	2.35	1.47
17:00	85	0.96	1.94	2.10	1.14
17:15	85	0.74	1.83	1.99	1.24
17:30	85	0.95	1.70	1.85	0.90
17:45	85	0.71	1.57	1.70	0.98
18:00	73	0.77	1.41	1.53	0.76
18:15	73	0.68	1.43	1.55	0.87
18:30	73	0.79	1.47	1.59	0.79
18:45	73	0.66	1.42	1.54	0.88

Table 67: Small Commercial Thermostat 15-minute Load Reductions August 19, 2019

Time	Temp (F)	Portfolio Load 15-min Avg. (kW)	Unadjusted Baseline 15-min Avg. (kW)	Adjusted Baseline 15-min Avg. (kW)	Reduction (kW)
17:00	88	1.14	2.14	2.41	1.27
17:15	88	1.30	2.04	2.30	1.00
17:30	88	0.88	2.00	2.25	1.38
17:45	88	1.08	1.73	1.95	0.87
18:00	86	0.71	1.59	1.79	1.08
18:15	86	1.16	1.58	1.78	0.62
18:30	86	0.70	1.46	1.64	0.93
18:45	86	0.96	1.55	1.74	0.78